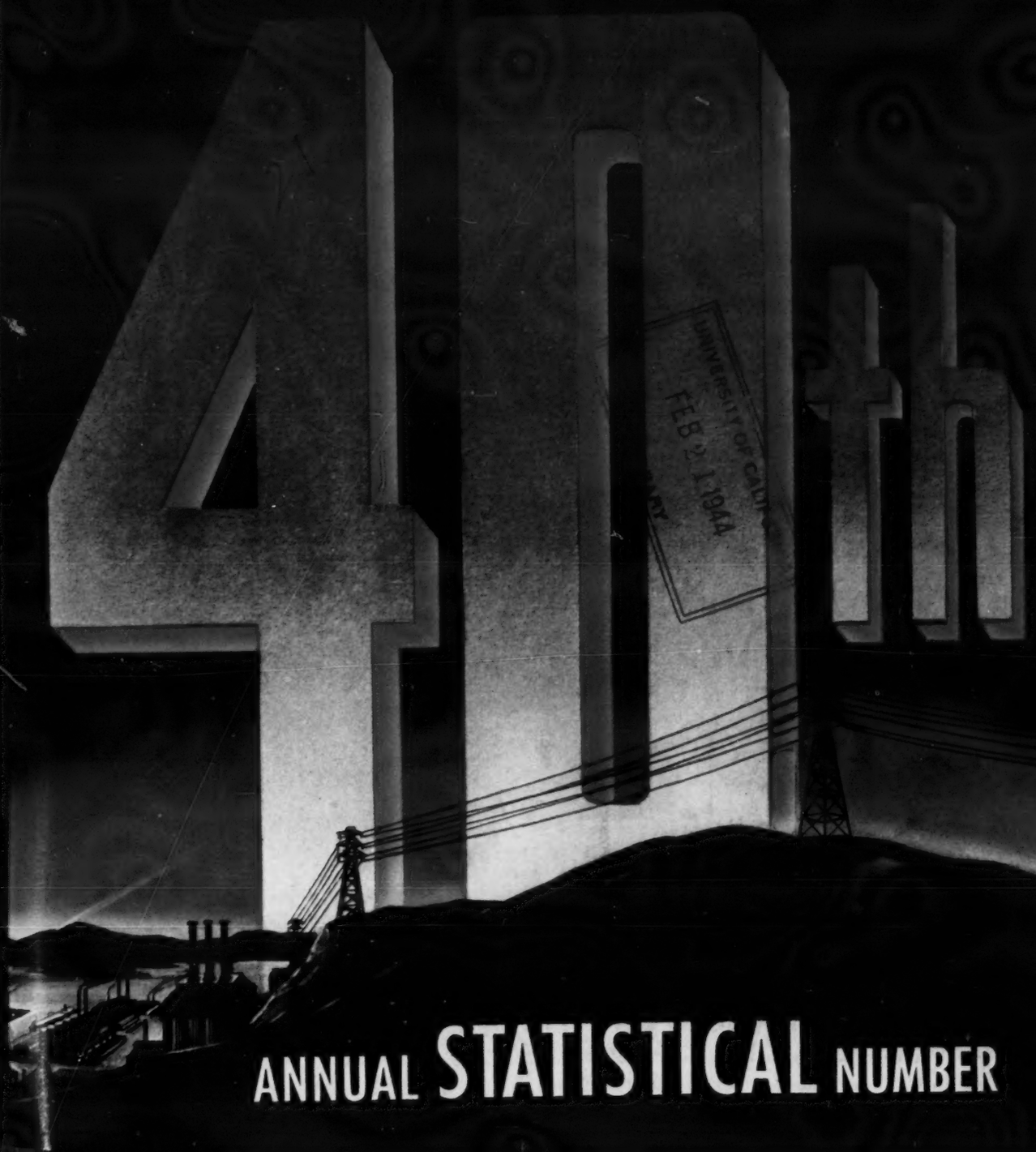
Electrical World

JANUARY 22, 1944



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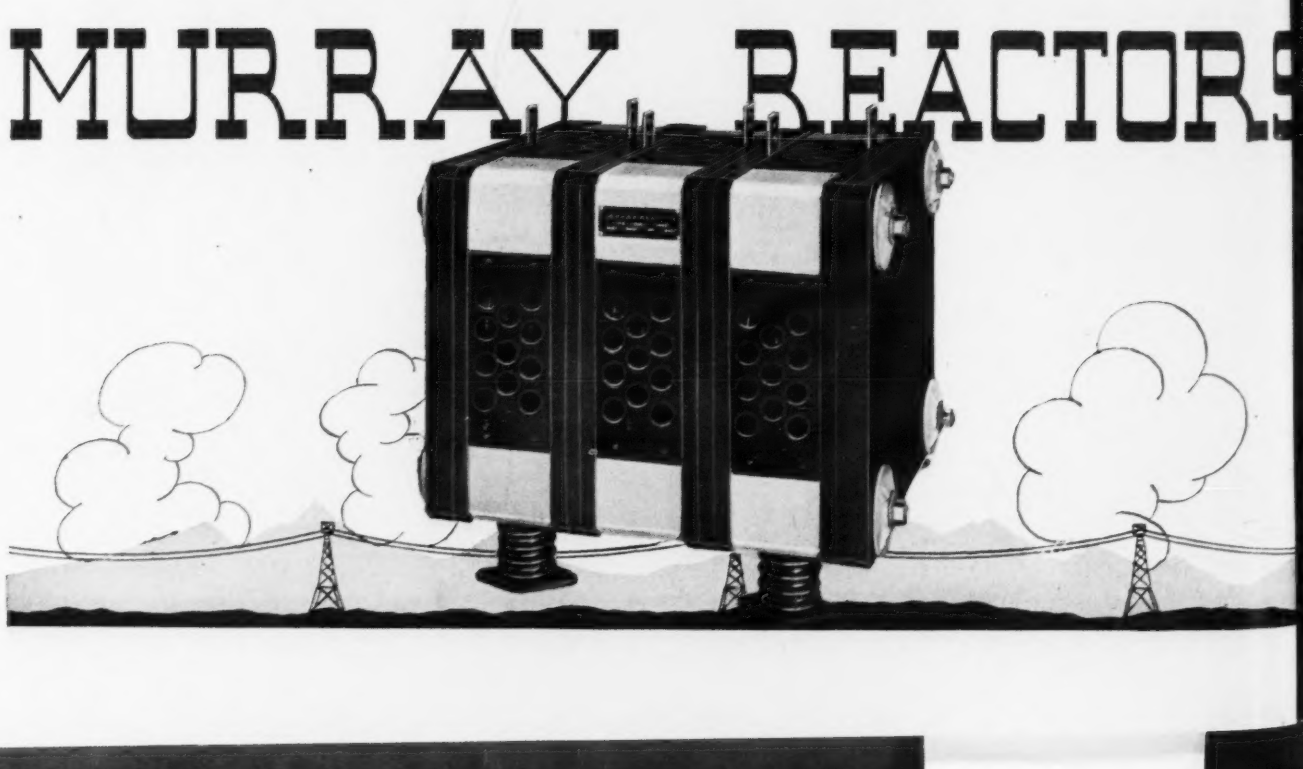
OF A NATION!

When destructive short circuits build up terrific overloads, your good Murray Reactors dissipate the excess long enough to give the circuit breakers their "second wind."

They are, indeed, the safety valves of America's stream of electric power. They save costly shutdowns. They keep industry *humming*. They keep the bright lights of progress *burning*. Every utility *needs full* Murray Current Limiting Reactor protection. Metropolitan Device Corporation, 1250 Atlantic Av., Brooklyn, N. Y.

MURRAY REACTORS



Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 70 YEARS

January 22, 1944 — Vol. 121, No. 4

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LECTRICAL WORLD

ublished weekly. Price 25 cents a copy. ublication office 99-129 N. Broadway, Albany, N. Y. Allow at least ten days for change of dress. Address communications about subriptions to Director of Circulation, Electrical orld, 330 West 42nd Street, New York 18, N.Y.

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bscription rates: In the United States, xico, Central and South American counes, $5 a year, $8 for two years, $10 for ee years, Canada $5.50 for one year, $9 two years, $11 for three years (Canadian ney at par). Great Britain and British ssessions, 54 shillings for one year, 108 illings for three years. All other countries for one year, $18 for three years. Entered second-class matter November 16, 1936, Post Office at Albany, N. Y., under the t of March 3, 1879. Printed in U. S. A. ntents copyrighted, 1944, by McGraw-Hill ublishing Company, Inc. Branch Offices: North Michigan Avenue, Chicago, 11, Ill.; Post Street, San Francisco, 4; Aldwych use, Aldwych, London, W. C. 2; Washing-, Philadelphia, Cleveland, Detroit, St. Louis, ston, Los Angeles, Atlanta, Ga.

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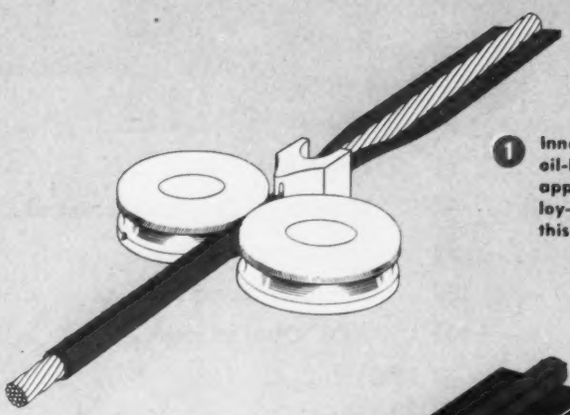
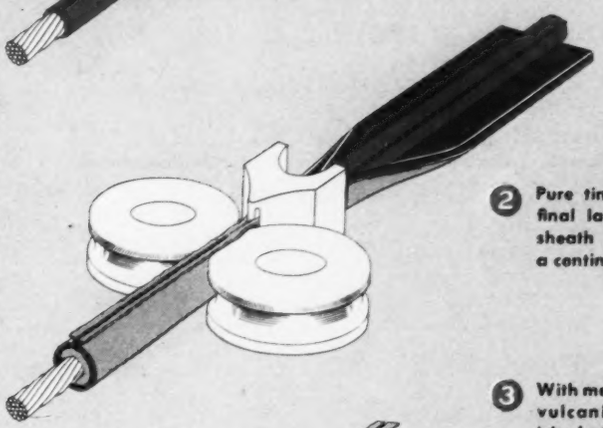
OKOLITE-

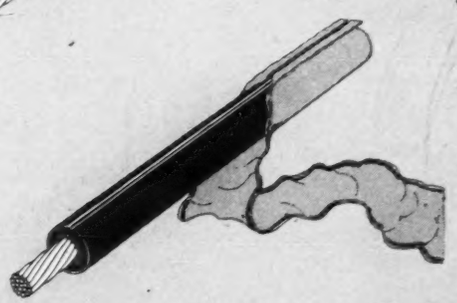
• HAS A HIGHLY-DESIRABLE COMBINATION



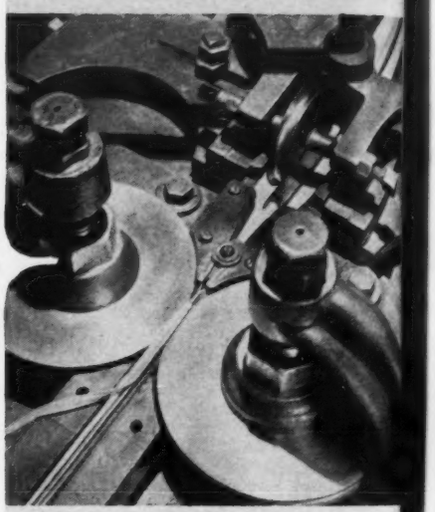
1 Inner strips of Okolite oil-base insulation are applied about the Okoloy-coated conductor in this manner.



2 Pure tin backing on the final layer of Okoprene sheath compound forms a continuous metal mold.



3 With metal removed after vulcanization, the finished Okolite-Okoprene wire is ready for testing and shipment.



3 ESSENTIAL STEPS IN THE OKONITE STRIP-INSULATING PROCESS

* Insulated with Okolite oil-base insulation and protected by a sheath of Okoprene, made with neoprene, Okolite-Okoprene cables may be installed in ducts, buried directly in the earth or exposed to the elements *without additional protection.*

3488

OKOPRENE*

OF IMPORTANT PROPERTIES . . .

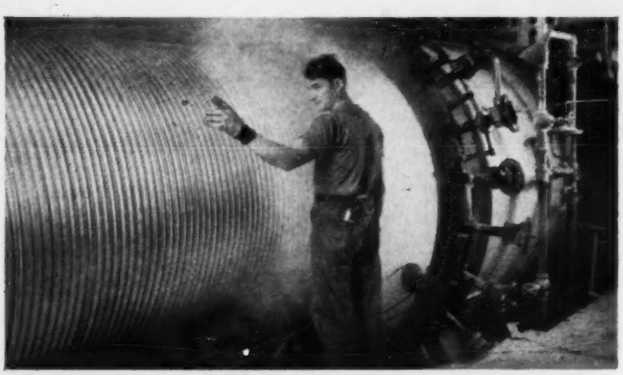
The accompanying table shows the many advantages of using Okolite-Okoprene wires. But these neoprene-sheathed wires have *all* these characteristics only because they are made by the strip-insulating process which starts by coating the conductor with Okoloy and ends by vulcanizing the insulated wire under pressure in a continuous metal mold. This Okonite method illustrated here, provides:

BETTER CONDUCTOR PROTECTION: All Okolite-Okoprene conductors are protected against corrosion by a coating of Okoloy, an *alloy that outlasts tin at least 2 to 1* (Bulletin OK-2019).

CONDUCTOR PROPERLY CENTERED IN INSULATION: The Okonite strip-process of insulating the conductor ensures a uniform wall of Okolite because it is applied in layers of *predetermined* thickness (Bulletin OK-1014).

UNIFORM SHEATH THICKNESS: Since the final layer of protecting Okoprene sheath is also applied by the strip-process, it, too, is of *predetermined* thickness.

SINGLE, HOMOGENEOUS ASSEMBLY: Both *insulation and sheath are securely bonded* together when vulcanized under pressure in the continuous metal mold. This results in greater density and uniformity and, hence, longer life.



Removing the drum of insulated conductor after vulcanization under pressure in its continuous metal mold.

PROVED IN SERVICE: Okolite-Okoprene wires, made by this 60-year old process, have been proved in service under every conceivable type of installation — on railroads, in power and light companies, mines, industrial plants, refineries and buildings.

Okolite-Okoprene wires and cables are available in all standard sizes and many colors for service up to 5000 volts. For further details, send for Bulletins OK-2007A, OK-2009C and OK-1008 . . . The Okonite Company, Passaic, New Jersey.

ELECTRICAL, PHYSICAL AND INSTALLATION ADVANTAGES FORM A WELL-BALANCED COMBINATION IN OKOLITE-OKOPRENE WIRES

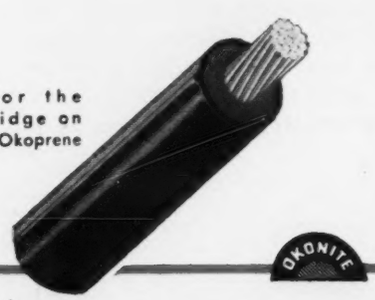
CONDUCTOR:
- Protected with Okoloy coating
- Resists corrosion
- Outlasts tinning 2 to 1

INSULATION:
- Okolite oil-base insulation
- Moisture-resisting
- Uniform thickness throughout length
- High, stable electrical values
- Meets W.P.B. wartime requirements

COVERING:
- Okoprene sheath made with neoprene
- Bonded securely to insulation
- No braids to rot
- *Resists:* sunlight, weather, flame, oil, chemicals and ozone
- Eliminates surface discharge and end leakage
- Provides smooth, tough covering

Okolite-Okoprene wires and cables are simple to handle, splice and terminate. If you are not already using them, it will pay you to know more about this modern, approved type of electrical cable.

Look for the single ridge on Okolite - Okoprene

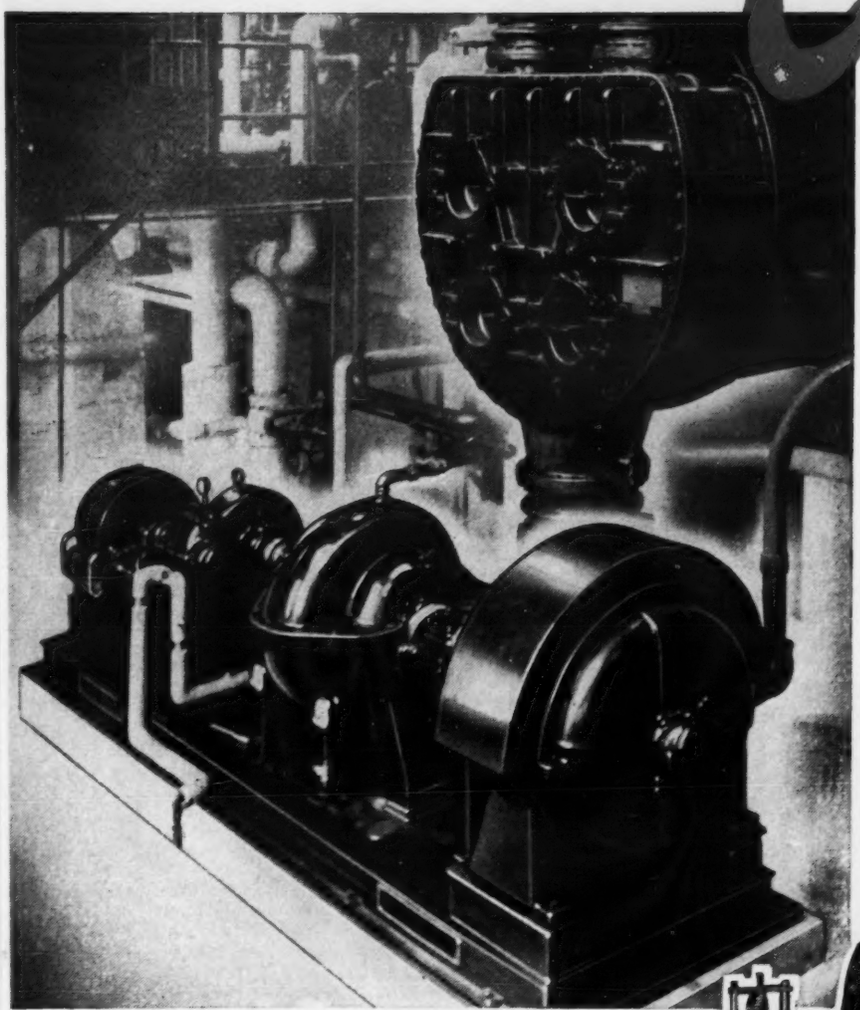


OKONITE

INSULATED WIRES AND CABLES

Turbine or moto

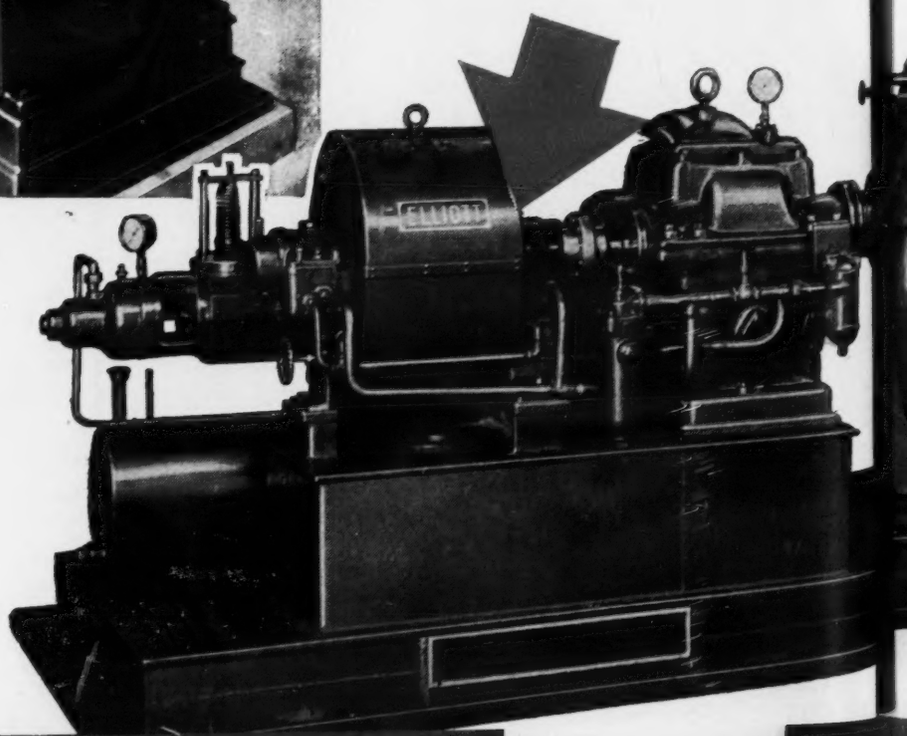
Elliott



Your heat balance may call specifically motor or turbine drives for various pow house auxiliaries, or for dual drives, as ill trated here.

Whatever the drive, its operating quali must emphasize smooth-running, troub free reliability.

That is why Elliott motors and turbi make such acceptable auxiliary drives. if there is one predominant quality of Ell engineering it is the practice of building ex performance ability into a machine, putt too much into a turbine or motor rather th



An all-Elliott installation in a mid-West power station. The picture shows the dual driven circulating pump and condenser. The turbine-generator unit, which the condenser serves, is also Elliott.

Q-1099A

for auxiliary drives?

builds both

skimp materials and workmanship for a order-line job.

The installation pictured is all-Elliott—the ondenser, its ejector, dual drives for both irculating and condensate pumps. (The rbine-generator which the condenser rves is, in this case, also Elliott.) Certainly instance of unified responsibility. Elliott ngineers, knowing all the operating nditions could do a fine coordinating job, sulting in unusually satisfactory and rmonious operation.

But, in any event, Elliott motors and rbines for auxiliary drives can add their extra stamina to the overall dependability factor of your plant.

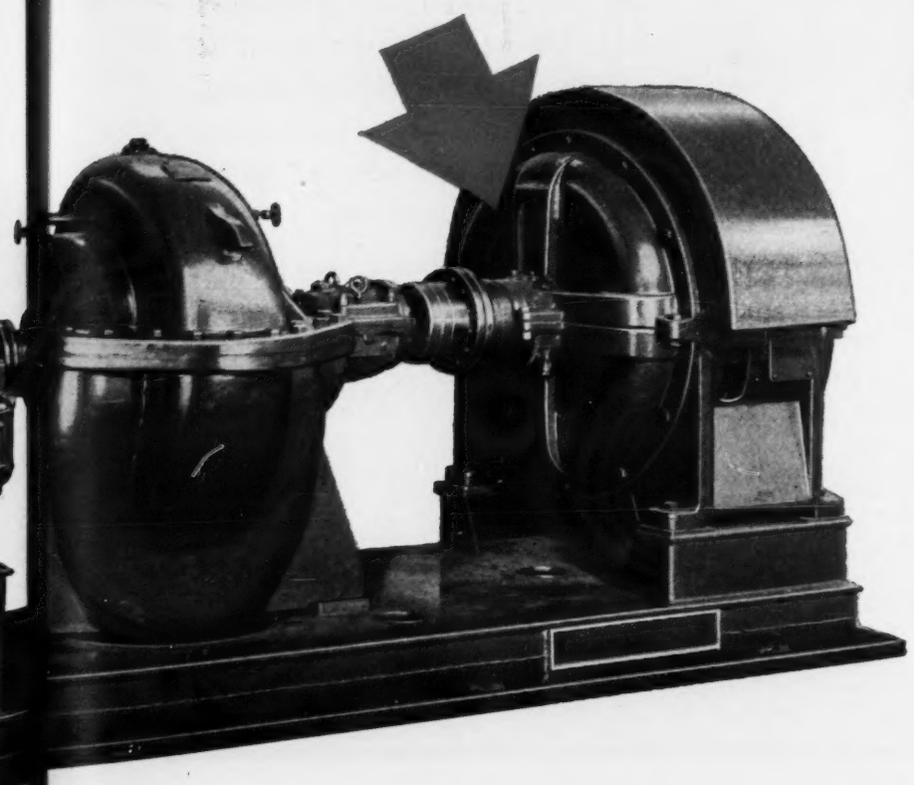
With a complete line of direct-drive or geared turbines, single-stage or multi-stage, and all types of motors required for power plant auxiliary drive, with an especially fine reputation for two-pole, 3600-rpm units, Elliott has the drive you need.

ELLIOTT COMPANY

JEANNETTE, PA. • RIDGWAY, PA. • SPRINGFIELD, OHIO

DISTRICT OFFICES IN PRINCIPAL CITIES

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS



A star has been added to the Army-Navy "E" flags flown by both the Jeannette and the Ridgway plants of Elliott Company.

—then he said to himself

"The LIE is my political weapon"

At the start of his activity, Adolph Hitler proclaimed to the world that his weapon was the LIE

—the all-out undiluted LIE

—and now see what happens to a structure founded on bosh:

(a) the theory of the blitz *blasted*

(b) the legend of invincibility *exploded*

(c) the infallibility of his "intuitions" *fizzled*

He could have fooled a lot more people for a lot longer time, if he had only tried the trick of nursing along old truths—now turned into fallacies—but still adhered to by the unthinking majority.

For *Progress* has a way of flipping the FACTS of yesteryear into FLOPS almost overnight. The follower of an OUTDATED fact may easily find himself nursing a progress-blocking FLOP.

Here, Adolph, are samples
of yesteryear FACTS now turned FLOPS

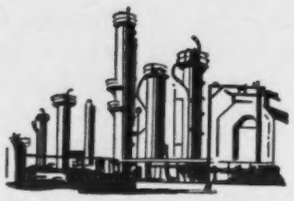
FLOPPED FACT 1:
"You can't produce all-welded ships" . . . . . .

....Recourse to arc welding has filled the seven seas with them.

FLOPPED FACT 2:
"You can't arc weld high-temperature, high-pressure piping" . . . . . .

....The one safe way is through recourse to arc welding.

FLOPPED FACT 3:
"You can't weld cracking stills" . . . . . .



....Without recourse to arc welding—our armed forces would be without high octane gas.

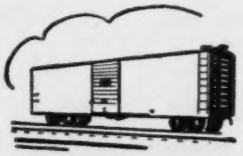
FLOPPED FACT 4:
"You can't produce army tanks with arc welding" . . . . . .

....Through recourse to arc welding—it's the only kind they're producing today.

FLOPPED FACT 5:
"You can't erect buildings by arc welding" . . . . . .

....Savings in steel and money are represented in thousands of structures of every type—through recourse to arc welding.

FLOPPED FACT 6:
"Railroad cars are taboo for arc welding" . . . . . .



....Watch them rolling the rails in every state—through recourse to arc welding.

THE LINCOLN ELECTRIC COMPANY • CLEVELAND 1, OHIO

America's greatest natural **recourse**

ARC WELDING

Fourth and final

SINCE MAN LEARNED TO USE IT, FIRE HAS DONE

GAS TURBINE — FIRE PROMISES TO DO MAN'S WORK

☛Not to be facetious — the difficult thing about fire is that it's hot. Hot to man, hot to machinery.

Primitive man and beasts, once burned, were twice shy of fire. Imagine the sense of power that surged through the first cave man with courage to pick up a flaming bough from a tree struck by lightning. How man and beast must have run from him!

FIRE-

In time, man learned to maintain as well as capture fire — later learned to make it. And he found he could keep savage beasts away with it, warm his family with it – cook, hollow dugouts, harden clay, soften and melt metal with it.

Finally he learned to make fire do the work of turning a shaft — to rotate a lathe, a pump, a generator.

But always the difficulty in harnessing fire to work was the tendency of fire to burn the harness!

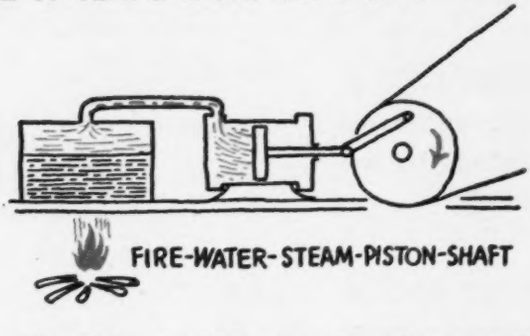
☛One thing fire couldn't burn was water. Instead, it did what seemed at first a curious thing — and later seemed perhaps a useful thing: it changed water into steam.

That water expanded as it turned to steam was evident to anyone who watched a lid bouncing on a steaming kettle.

In ancient Greece, Hero employed this effect to construct a toy — curved nozzles radiating from a hollow globe. Steam introduced into the globe blew out through the nozzles, and reaction of the device was to rotate.

James Watt and his predecessors knew of too many ways to employ the force of expanding steam usefully to experiment with toys. They conducted steam from a boiler to a cylinder, where it forced a piston back and forth to pump water out of deep mine pits in Cornwall.

Later, a connecting rod and cranking arrangement were added to enable the piston to turn a wheel and shaft.



FIRE-WATER-STEAM-PISTON-SHAFT

Greatly as the steam engine was improved in time, it suffered from two inherent disadvantages: boilers cost money, took up space, needed refilling; and reciprocating machinery dissipated too much energy in friction.

☛Invention of the internal combustion engine moved fire closer to the crank so that only a piston and a connect-

ALLIS

conquest of fire...

MUCH OF THE WORLD'S WORK. AND NOW — IN THE MORE DIRECTLY AND CHEAPLY THAN EVER BEFORE!

ing rod separated it from the shaft. Now, expanding combustion of fuel in a closed cylinder could exert force directly against the piston.

This new triumph over fire was celebrated in the horseless buggy, the flying machine, the portable power unit.

That fire had its destructive effect on metal engine parts and their lubricant was an early disadvantage which has since been greatly reduced. More serious, perhaps, is friction of reciprocating machinery within the engine. It causes wear, necessitates maintenance, robs the engine of output.

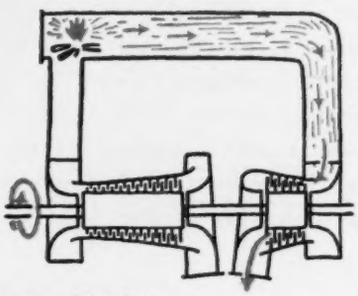
☛Thus the fourth and final step in the conquest of fire for power purposes has been to apply fire directly to turning the shaft and rotating element — WITHOUT USE OF RECIPROCATING MACHINERY — and that's exactly the engineering job that Allis-Chalmers has tackled in the new gas turbine!

As an idea the gas turbine's not new — as a useful prime mover, war-born research and development at Allis-Chalmers tend to indicate it can operate at efficiencies equal to or better than diesels . . . and with the simple lubrication of steam turbines.

Operation is simple: in one type of useful cycle, motor starter turns compressor, which supplies air to combustion chamber at about 50 psig. Fuel burner heats air to 1200 F., increases its volume without increasing pressure. Heated air rushes through turbine and turns shaft. Motor starter disconnects.

Right now — such top priority uses as high octane gasoline cracking plants take all units Allis-Chalmers can build. So — don't even think about sending us an order for a gas turbine today.

We can't tell you how many we've built — or are building today — but the total may be greater than for the rest of the world combined.



FIRE-SHAFT

To sum up: sometime after the war — look for compact, low cost operating power from gas turbines. Among possible future applications: power plants, locomotives, fast ships, planes.

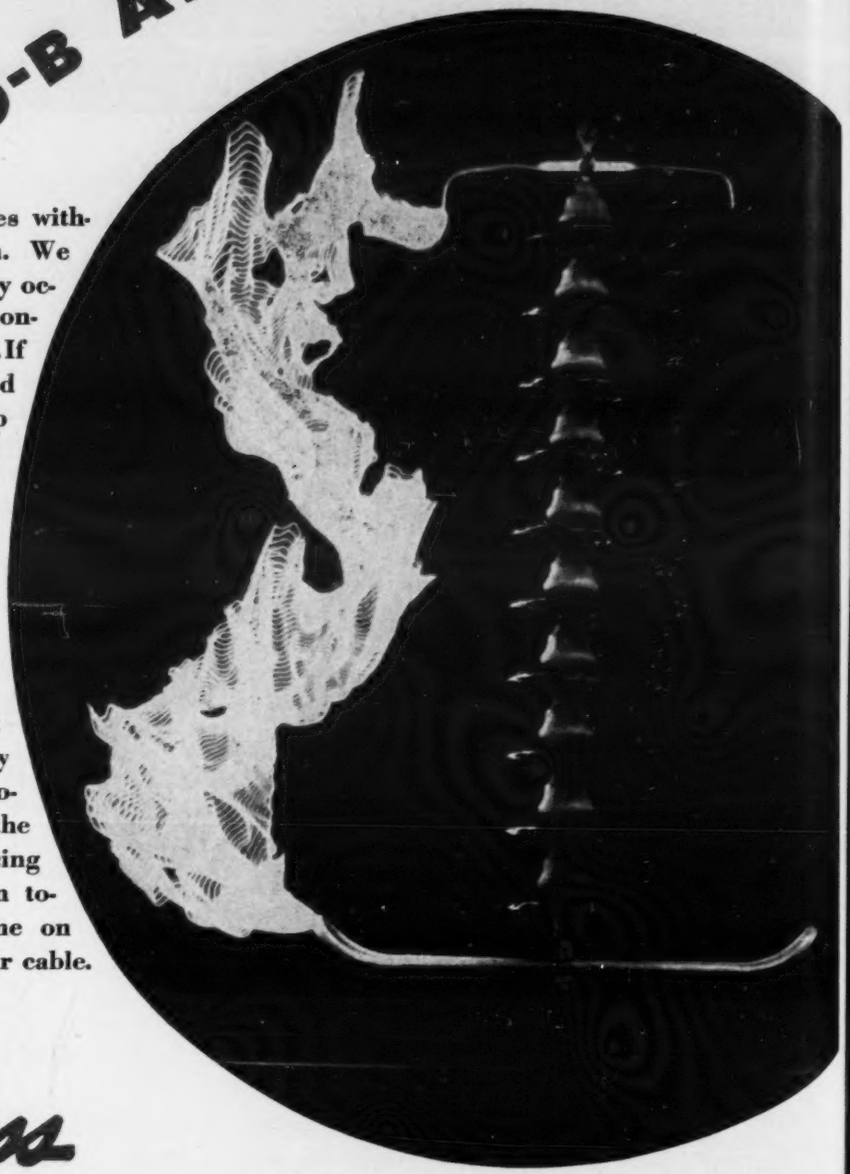
Look for other important new developments in power and electrical equipment from Allis-Chalmers. Maybe we can help you — maybe you can help us. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 1684

-CHALMERS

Why your conductors should be protected by O-B ARCING HORNS

MANY flashovers clear themselves without resulting in a serious interruption. We may not even know exactly where they occured. But a year or two later, the conductor fails for no apparent cause...If we examine the break closely we find evidence of a small burn. This sets up a weakness that, in times of unusual stress, leads to failure. These "mysterious" breaks caused by supposedly harmless flashovers are not uncommon...With conductor so difficult to get today, and with service continuity so urgent, it will pay you to investigate O-B arcing horns. These devices form a target for flashovers that would otherwise strike the cable. They do just one thing and do it well--protect your precious conductors from the hazard of flashover burns. O-B arcing horns will make a real contribution toward reducing "out-of-service" time on your power lines and preserving your cable.



Flashovers stay away from conductors with O-B arcing horns, thus preventing a common cause of burns that lead eventually to conductor breaks. These horns do not reduce structure clearances or string length. Note: Small strap horn at top of insulator string is optional, depending upon whether insulator protection is desired.

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED.
NIAGARA FALLS, ONTARIO

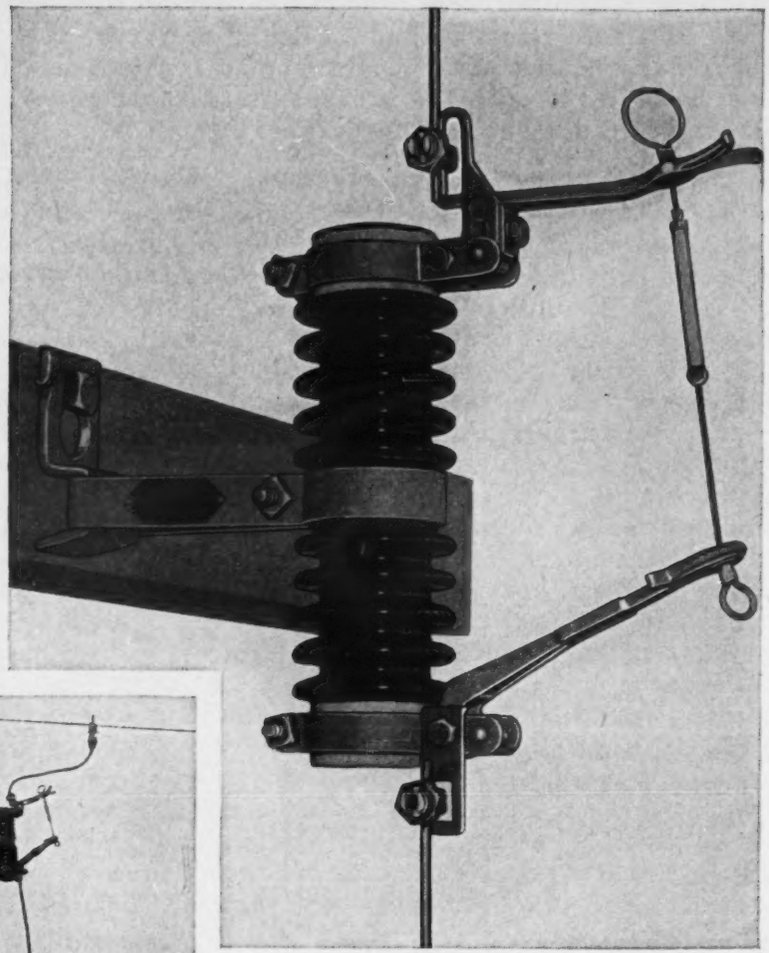
2466-H

← O-B Longhorn for voltages below 161 kv.

→ O-B Bighorn for voltages of 161 kv. and above.

Matthews Protectolink Cutouts Conserve Essential War Materials and Reduce Costs

Protectolinks Can Be Installed and Removed With Standard Ball Point Hot Stick



Made in the Following Sizes

• ● •

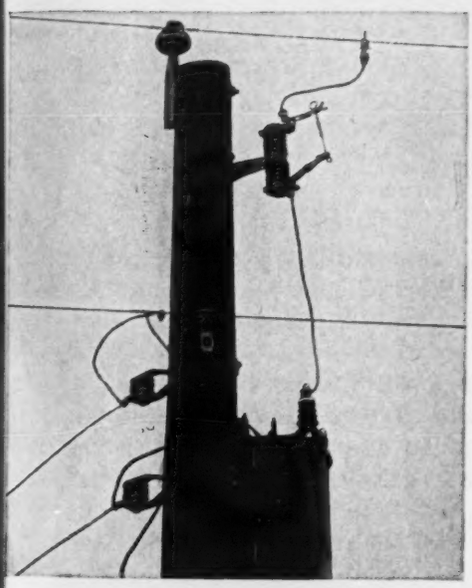
Catalog 1639
50 Amperes
5000 Volts

• ● •

Catalog 1640
50 Amperes
7.5/12.5 Kv.
Grd. Y

• ● •

Catalog 1641
50 Amperes
15000 Volts



Write for Bulletin 101-A
It Gives Complete Information

In this Wartime emergency, the problem of conserving materials which are essential to our Victory Program rests upon all of us. MATTHEWS PROTECTOLINK CUTOUTS use a minimum of copper and steel and the elimination of fuseholder tubes conserves fibre and bakelite; therefore they will help you to accomplish considerable savings in these materials and in addition show you dollar savings.

They are rugged in construction. Spring tensioned lower arm separates Protectolink instantly when short circuit or meltout occurs. Hooked lower arm and forked upper arm facilitates installation of Protectolink; these fuse links are designed so they cannot be installed upside down and will fit any make of open link cutout. Protectolink buttons fit snugly into cupshaped recesses in upper and lower contact arms, assuring positive and radio noise-proof contacts.

W. N. MATTHEWS CORPORATION

SAINT LOUIS, U. S. A.

ENGINEERS and MANUFACTURERS SINCE 1899

KELLEMS COMPANY

SAUGATUCK, CONNECTICUT

January 4, 1944

Dear Electrical Industry:

I can do no better this month than to send you a copy of my letter to the three outstanding labor leaders in our country. And I'm just as interested in what you have to say upon the subject as in their replies. So come on with it, I'm all set for the deluge.

Sincerely yours

Vivien Kellems

(COPY)

Mr. John L. Lewis, President
United Mine Workers of America
Washington, D. C.

Dear Mr. Lewis:

The Connecticut Committee for the Equal Rights Amendment has requested me to write to you, Mr. William Green, and Mr. Philip Murray, for a statement as to your respective positions on the proposed Equal Rights Amendment.

You are no doubt aware that the Judiciary Committee of the House of Representatives has tabled this resolution by a vote of 15 to 11. You are probably also aware that American women now enjoy the right to die in uniform for their country but in civil life they suffer severe legal disabilities under laws in the various states that make them and their property subject to their husbands' control, deprive them of just and human rights over their children and limit their ability to earn their living.

The Equal Rights Amendment to the Constitution would rectify these grievous wrongs and give to women the same rights under the law as men, both colored and white, now enjoy. This is such obvious common sense, not to mention long over-due justice, that it is difficult to see what sound objection could be advanced against it. We find ourselves in the strange paradox of fighting a war for freedom, yet denying the women of the United States the very rights we would bestow upon other people all over the world. It would seem that before we buckle on our armor to free the whole world, we could very well do with a little "freeing" right here at home. Certainly this war has proven that the drooping-lily-by-the-brookside era is a thing of the past and that women are red-blooded human

beings, giving without stint of that very blood and the labor of their hands and heads, ready and capable of assuming their share of work, responsibility and heartache. I say proudly that this war could not be won were it not for the women of the United States. Unquestionably one of the determining factors in delaying the passage of this Amendment has been the opposition of organized labor. While individual unions such as the Central Labor Union of Pittsburgh have endorsed the Amendment, not one national union or national labor leader has declared in favor of it. Probably this is due to the fact that much misunderstanding and prejudice surround the subject and many well-meaning but misguided people have feared it was directed at so-called protective legislation for women.

In my opinion many of these alleged "protective" laws, while lofty in purpose, have actually been restrictive in application and have meant untold hardship to women who, of necessity, have to earn their living. And they have been discriminatory in the extreme. For example, when the New York law forbidding women to work at night went into effect, thousands of women holding lucrative night jobs (the night shift usually pays more than the day shift) were thrown out of work at one fell swoop but patient scrub women continued uninterruptedly to clean the very offices where these women had worked - <u>at night.</u> No hearts bled for these women. If it is dangerous to the health and morals of women to work at night, why were scrub women not included in the law? Could it possibly be because men were not exactly forming lines to the right, clamoring to scrub floors?

Most of these "protective" laws have had to go right out of the window for the duration, which would prove to any thinking person that they are archaic. Is it planned to drag them out, dust them off and set them up again when this war is over? I cannot speak for the rest of the United States but I am sure that if an attempt is made to reinstate that mouldy, old "curfew" law in Connecticut (which Governor Baldwin has wisely suspended for the duration of the war) and again fasten it upon the women in our state, we will pick up our hammers, our welding torches, our wrenches and all of the other hand tools which you men have taught us to use so expertly, and we won't use them to make munitions, either.

Unfortunately many women will have to work when this war is over who did not before. It is tragically too true that we shall have thousands of young widows, many with little children, and as many thousands of single women who cannot marry as there won't be enough husbands to go round. Are we again, under the guise of "protection" going to restrict and limit these women in their right to a job on equal terms with men? If it is good to "protect" women workers, then why not men workers? Aren't they human beings also? Since the Federal Wage and Hour Law fixes maximum working hours and minimum wages for all workers, do you feel that women still need additional laws regulating their work? What is the function of the Union if not to vigilantly watch that abuses for either men or women do not occur?

It is unfortunate that the debate over "protective" legislation has obscured the real issues and objectives of the proposed Amendment and I am sure that a forthright statement from you, Mr. Green and Mr. Murray will clear the misconceptions from the minds of many people and our legislators will have the courage to bring this resolution to the floor of the House of Representatives for debate.

Sincerely yours,

Vivien Kellems

KELLEMS COMPANY

SAUGATUCK, CONNECTICUT

January 4, 1944

Dear Electrical Industry:

I can do no better this month than to send you a copy of my letter to the three outstanding labor leaders in our country. And I'm just as interested in what you have to say upon the subject as in their replies. So come on with it, I'm all set for the deluge.

Sincerely yours

Vivien Kellems

(COPY)

Mr. John L. Lewis, President
United Mine Workers of America
Washington, D. C.

Dear Mr. Lewis:

The Connecticut Committee for the Equal Rights Amendment has requested me to write to you, Mr. William Green, and Mr. Philip Murray, for a statement as to your respective positions on the proposed Equal Rights Amendment.

You are no doubt aware that the Judiciary Committee of the House of Representatives has tabled this resolution by a vote of 15 to 11. You are probably also aware that American women now enjoy the right to die in uniform for their country but in civil life they suffer severe legal disabilities under laws in the various states that make them and their property subject to their husbands' control, deprive them of just and human rights over their children and limit their ability to earn their living.

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Sincerely yours,

Vivien Kellems

Announcing . . . Type PC

A new

Its Advantages

1. Insulation maintained thoroughly saturated with compound at all times.

2. Internal pressure is stabilized within prescribed limits.

3. Controlled sheath stresses. There is no repeated expansion and contraction, no fatigue or splitting of lead.

4. Pressure along cable line is uniform, not variable from joint to center of section to joint.

5. Sheath supervision is not required. Failure rates from other than inherent causes too low to justify supervision.

6. Interchangeability. Cable can be spliced to existing solid type cable without difficulty.

7. Increased current carrying capacity. Many present-day limits are based on allowable sheath stress — type PC Cable controls these stresses.

8. Improvement in operating voltage stress is possible, since ionization and gas inclusions are eliminated.

9. Reduced overall transmission cost per KVA mile.

10. Strategic materials and metals may be saved.

Pressure Compensated Cable

development in Paper Insulated Power Cables

● HERE is an improved power cable that offers you all the usual advantages inherent in paper insulated cable, plus the additional feature of much greater operating reliability.

Type PC Cable differs from the ordinary "solid-type" paper insulated cable in only one respect—but an important one. Included in the impregnated fillers are one or more small lead tubes. By this unique and simple expedient is obtained stabilization of operating pressures within fixed limits.

The pressure-compensating "gas cushion" is the secret

Note the schematic diagram below. The helical tubes are filled with dry nitrogen gas and are perforated at intervals of approximately four times the length of lay. Perforations in the tubes are staggered so that there is a perforation—hence, contact between insulating compound and gas—every one and one-third lengths of lay. During manufacture, excess quantities of the cable saturant are forced into the several perforations.

When the cable is installed, slugs of the compound gradually collect in the low portions of the tubes. The gas collects in the domes.

During the application of the load, which causes expansion of the compound and increases the internal pressure, additional saturant is forced into the tubes through the perforations.

This merely compresses the gas entrapped between the slugs and thus acts as a cushion to prevent development of pressures which would normally stretch the lead sheath.

Pressure is very uniform along the entire cable length—there are no points of concentrated pressure—due to the fact that the maximum distance to points of pressure stabilization are equal to one-half the spacing between perforations.

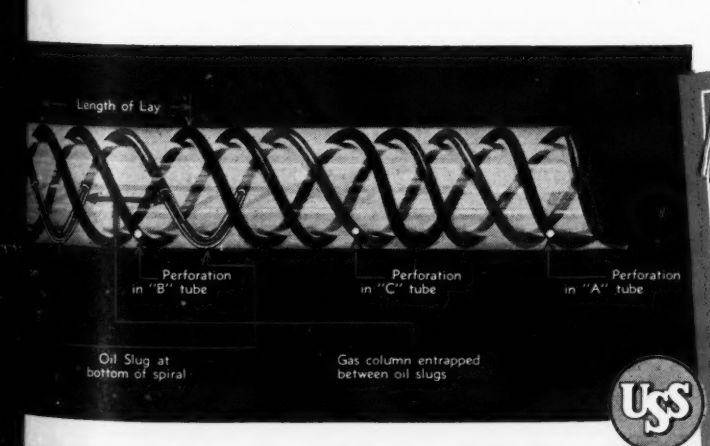
When the cable cools and the oil saturant contracts, the compressed gas in the tubes forces the oil back again into the cable, thus preventing wide swings from pressure to vacuum as encountered in ordinary "solid-type" cable.

In PRESSURE COMPENSATED Type PC CABLE the positive pressure operating characteristics of "oil-filled" and "gas-filled" cables are obtained at very moderate increase in cable cost and with practically no increase in either the cost or difficulties of installation and supervision. A bulletin on PC Cable has just been issued. Send for it.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York


Length of Lay
Perforation in "B" tube
Perforation in "C" tube
Perforation in "A" tube
Oil Slug at bottom of spiral
Gas column entrapped between oil slugs

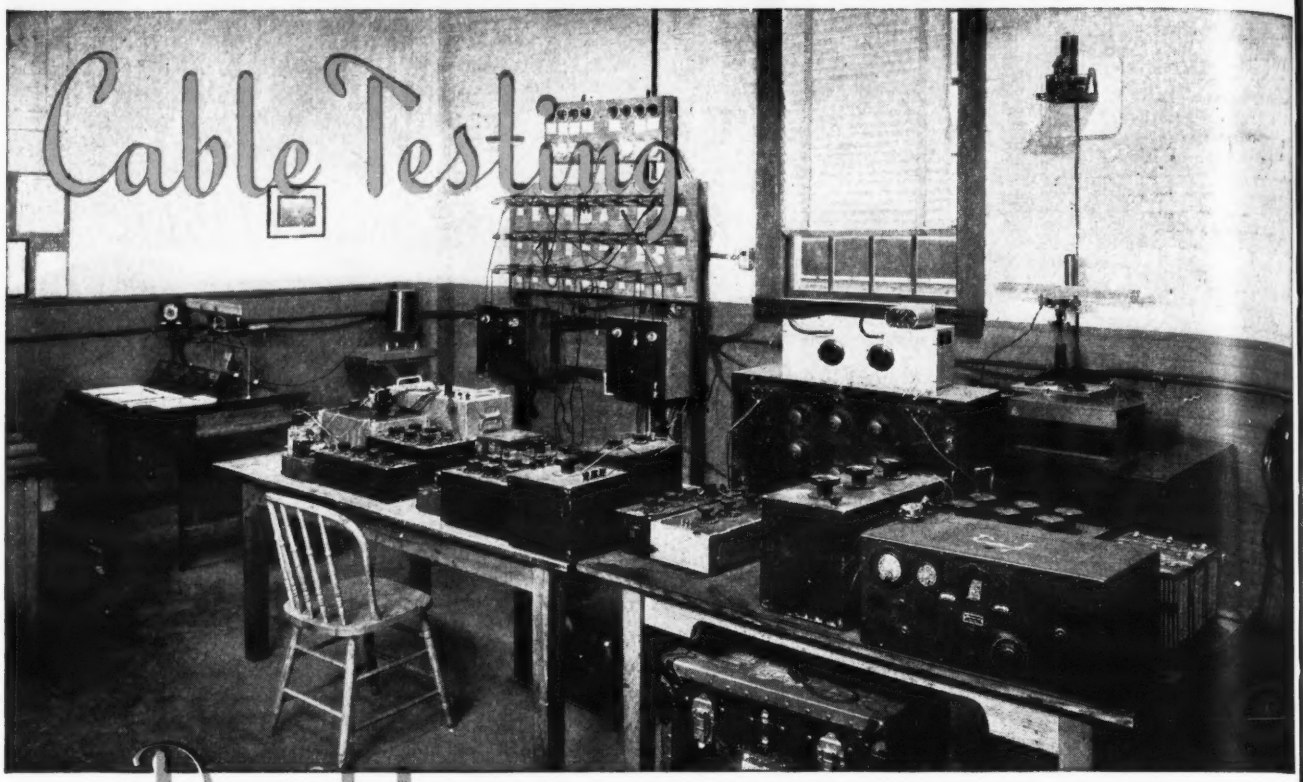
Awarded to the Worcester plants of American Steel & Wire Company

ELECTRICAL WIRES AND CABLES

Deliver the power that multiplies manpower

USS

UNITED STATES STEEL



IS Doubly IMPORTANT NOW . . . .

The excellence that has for many years distinguished Simplex insulated wires and cables has not been accidental. It was the natural result of careful supervision of materials and processes supplemented by both routine and special electrical tests during manufacture. Electrical tests are doubly important now because of restrictions limiting the use of scarce, critical materials.

If you are engaged in essential war work and need cables engineered to fit your operating conditions, it will be worth while for you to learn what Simplex controlled quality may mean for you.

Simplex insulated wires and cables conform to government specifications and regulations but to maintain Simplex quality while meeting these unusual war-time limitations we have at times found it necessary to assemble special testing equipment for unusual, out of the ordinary, tests. The results have more than justified the extra work. Simplex quality is being maintained.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

CHECK the FACTS

Seems just yesterday that the hand of R&IE was designing and building switching equipment only.

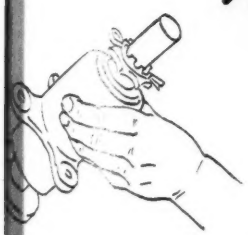
Today this business of winning a War has diverted a great portion of that effort.

Now - those busy hands can measure a gnat's eyebrow. The new problems call for tolerances from .010 to .0005 part of an inch - on the production line. This diversion has contributed greatly to the R&IE ABILITY to produce.

WHAT'S IMPORTANT TO YOU - THE HAND OF R&IE HAS IMPROVED ITS SKILL FOR THE PRODUCTION OF YOUR POST-WAR SWITCHING EQUIPMENT NEEDS.

TODAY
Parts for Anti-Aircraft Guns, etc., get FIRST attention.

The HAND of R&IE HAS IMPROVED ITS SKILL



TOMORROW
Parts for HI-PRESURE CONTACT Switching Equipment get ALL the attention.

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OSED,
- METAL CUBICLES
- TESTING DEVICES

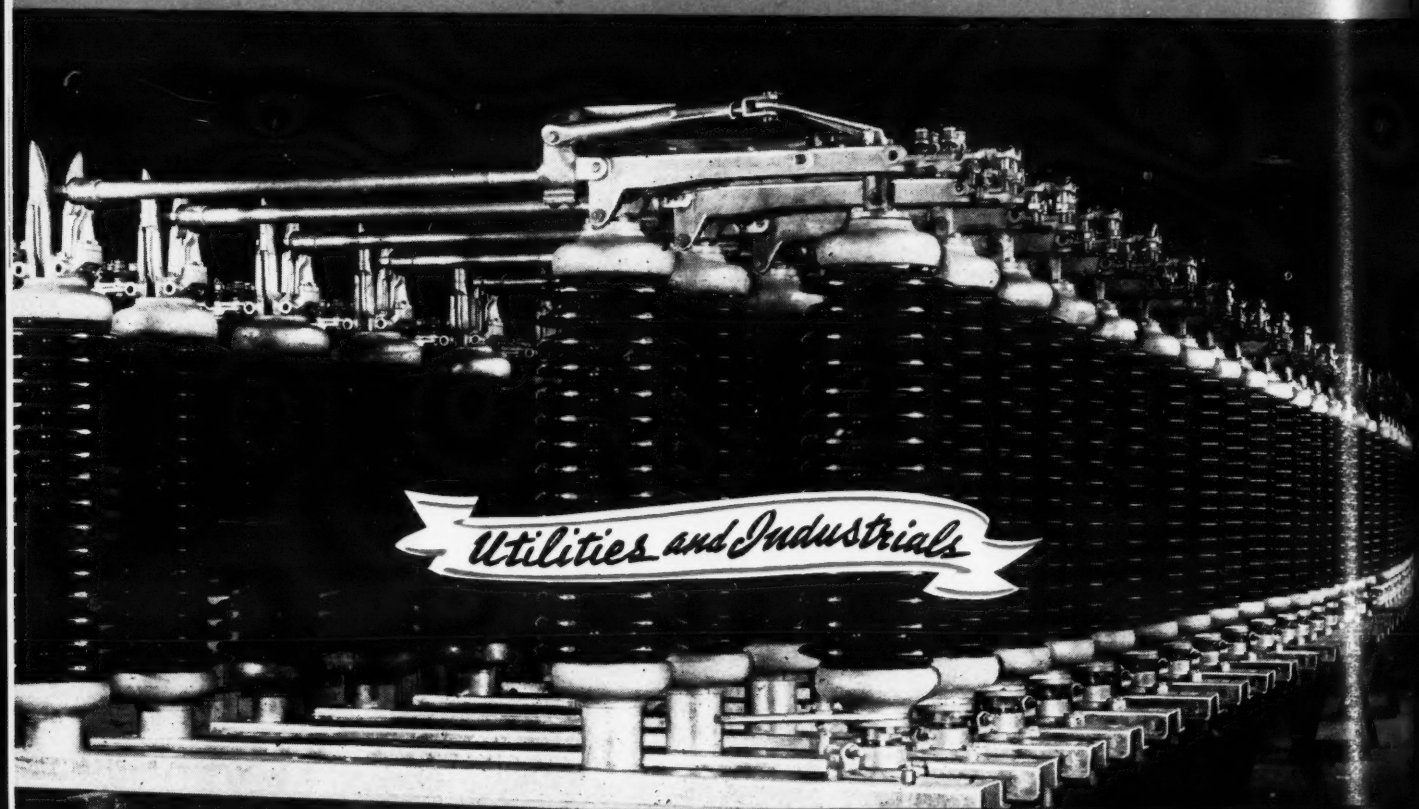
RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

PRODUCTION OF DIVERSIFIED PARTS FOR WAR IMPLEMENT

Parallel Lines of R&IE War Productio

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG,

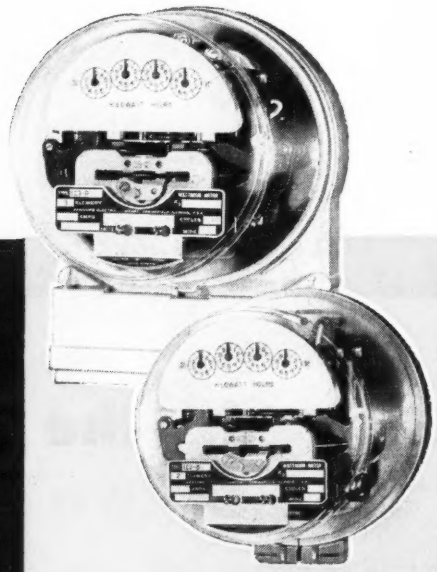
PRODUCTION OF SWITCHING EQUIPMENT FOR WAR E



WAR BONDS MAKE
UNCLE SAM MORE
POWER-*full*

"On Measurement is founded the whole progress of man.."

Can't you almost take the words right out of this Roman lassie's mouth? "I've been undone," she is about to exclaim as she watches the weight swing downward while her newly boughten gems swing high and lightly. She had been told that the Egyptian "Talent" was the same as the Roman "Libra". It was, too. That is, almost. If sufficient detailed information had been given, it would have revealed that the Talent was slightly lighter than the Libra — enough to unbalance her scales. There are no such uncertainties in today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watthour meters.



NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

Give him the answers before it's too late!

● When fire breaks out at your plant, will the confusion of your men give the blaze time to get out of control? Not if they've been shown exactly what to do. Men *who know how* act swiftly and confidently to nip small fires.

Make sure your key men have the training they need. Stage a demonstration now. Let them see your equipment go into action against real fires. Explain the different types of fire and the right way to fight each of them.

To help you plan an interesting, instructive show, Walter Kidde & Company has issued a booklet, "HOW TO TEACH FIRE FIGHTING." Write for your free copy today.

Kidde

WALTER KIDDE & COMPANY, INC., 125 MAIN STREET, BELLEVILLE, N. J.

nly S & C Load Interrupter Disconnects an Do This Open Type Load Switching Job

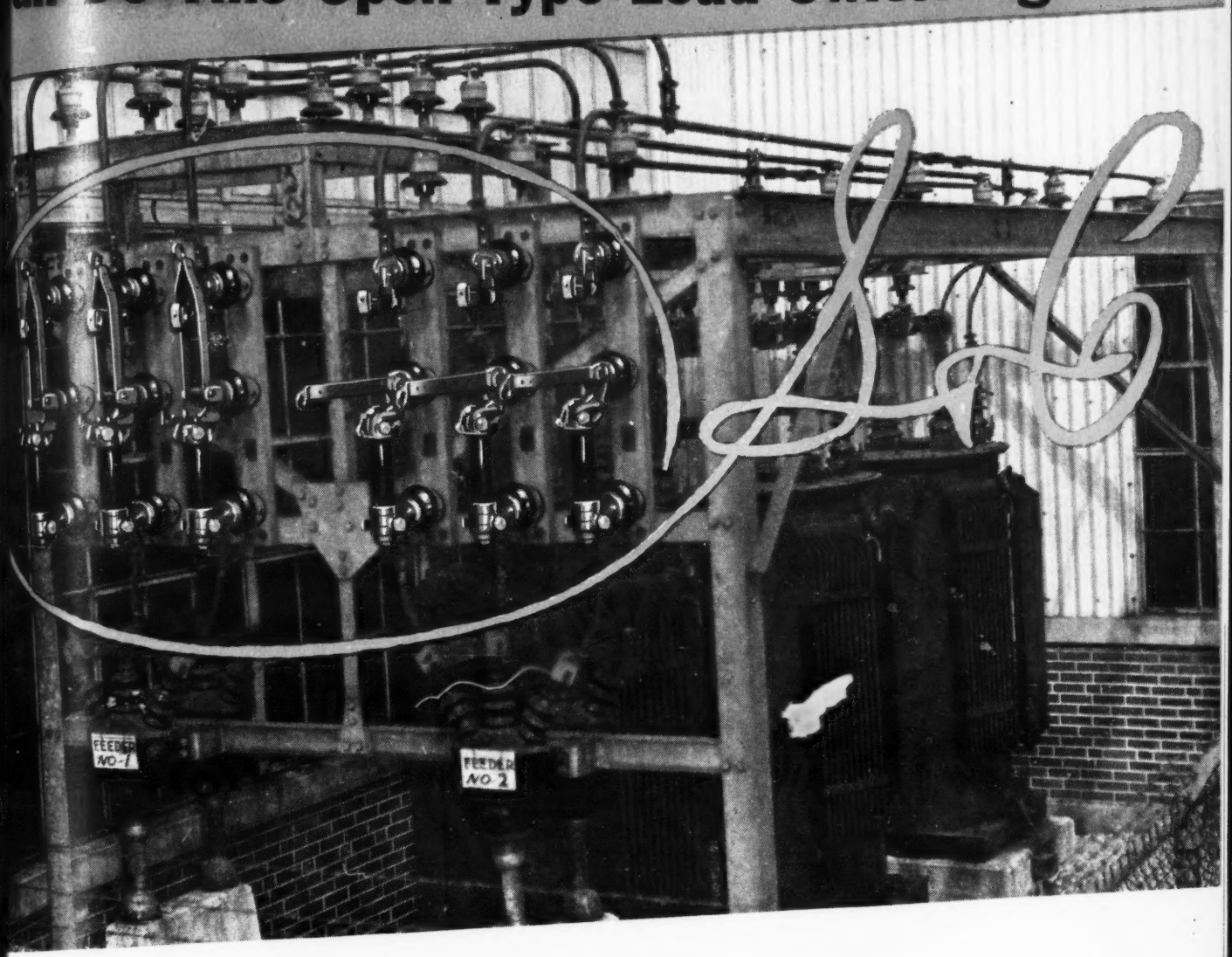


Illustration shows S & C Load Interrupter Disconnects and Type "SM" Fuse installations. Disconnects closed at left and open at right.

Load Switched to Load Centers from Either of Two Sources

TO be sure of continuous service for this essential war plant,—the substation is supplied from two service cables.

To switch to either of these feeders, S & C Load Interrupter Disconnects are installed,—the *only* open type Interrupter Disconnects suitable for outdoor load switching of this kind.

Besides load switching operations short-circuit protection is provided by S & C type "SM" Fuses on the same mounting base.

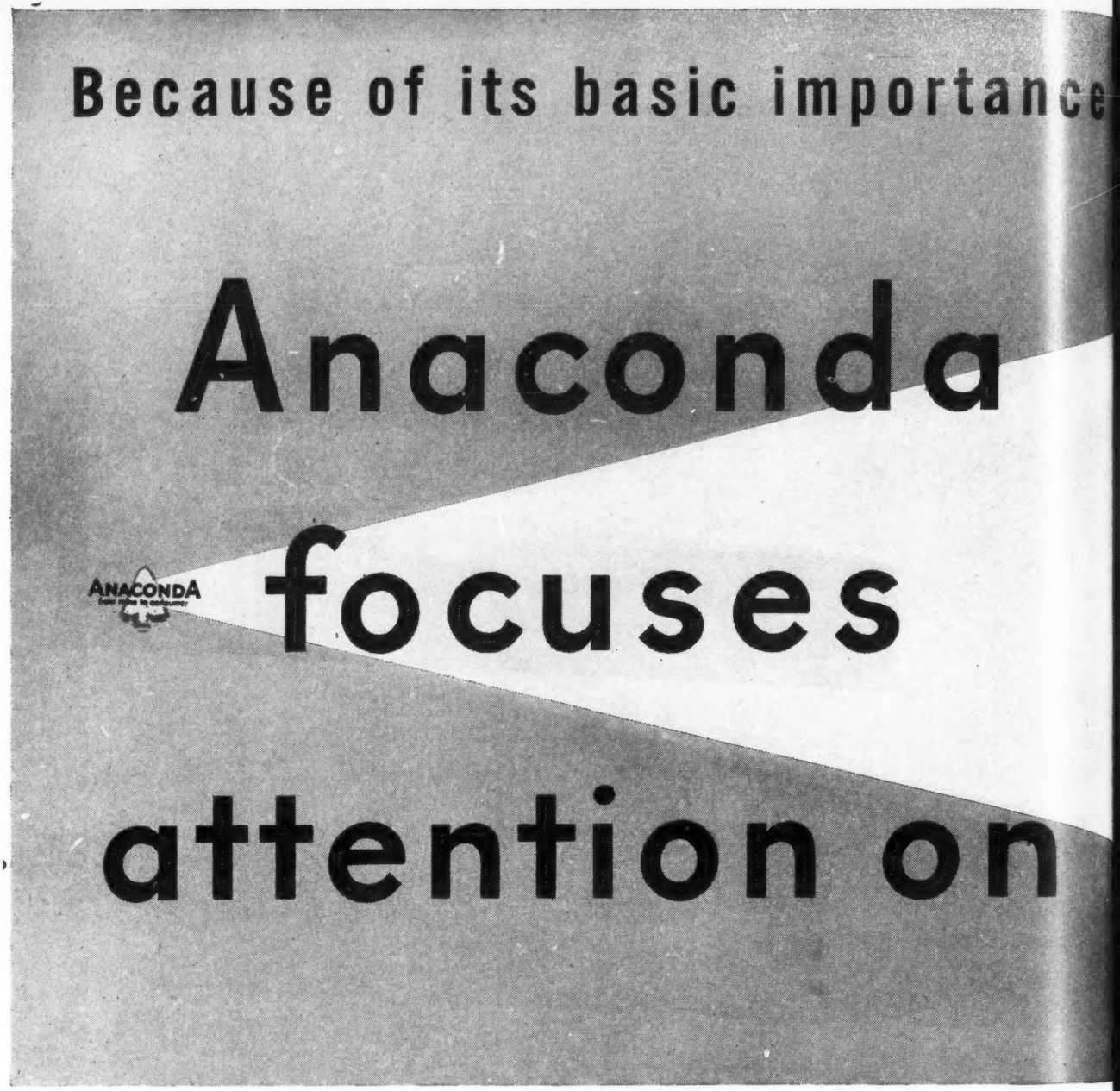
With S & C Load Interrupter Disconnects, load currents up to 400 amperes at 15000 volts can be interrupted—*without arcing at main switch contacts.* Substantial initial and maintenance savings are effected. Space, weight and installation time are reduced.

Consult S & C engineers the next time you have a job of this kind.

SCHWEITZER & CONRAD, Inc.

4435 Ravenswood Avenue **Chicago 40, Illinois**

Supplied in Canada through Powerlite Devices, Ltd., Toronto, Ontario



Nothing is more basic in furthering the interests of the electrical industry as a whole—and of each individual branch—than the promotion of electrical wiring. This has long been the number one belief with Anaconda Wire & Cable Company.

THE PAST

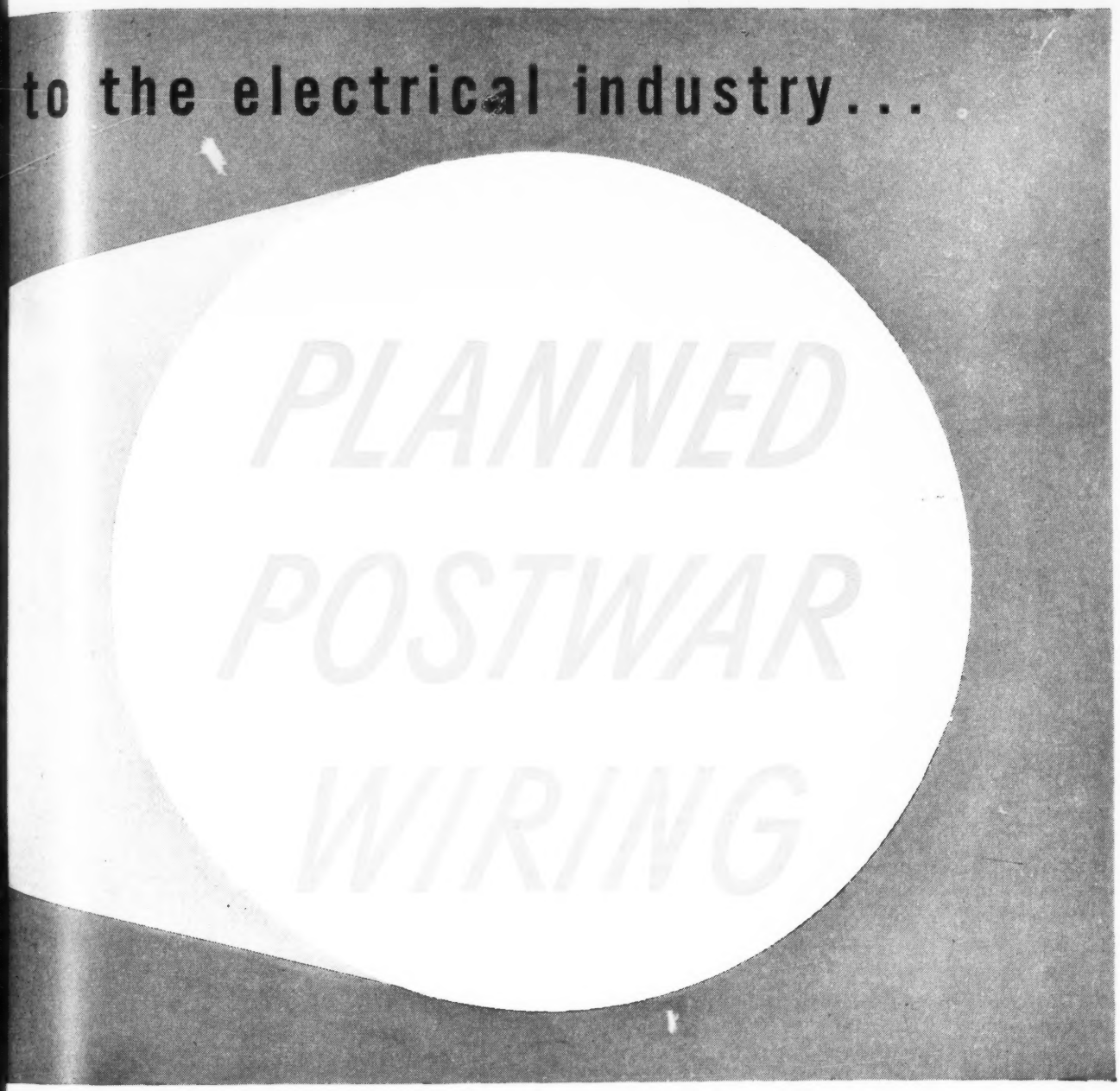
You probably recall the "Electrical Modernization" campaign of Anaconda prior to the war. It helped stimulate national interest in better wiring for Industry and helped to prepare Industry to meet the challenge of war production.

THE PRESENT

A more recent example is the "Preventive Maintenance" campaign developed by Anaconda engineers to meet wartime conditions. Based upon practical methods of conserving electrical circuits and equipment, it is being widely used.

Electrical Wires and Cables of Copper are the Life-Line

to the electrical industry...



THE FUTURE

Today, the time is ripe for another step forward in furthering adequate wiring. We believe we can render a constructive service to the electrical industry and to business in general through a national campaign promoting the importance of *postwar* wiring.

Its objective will be to stimulate *advance thinking* about adequate wiring...to drive home to industry, municipalities and home owners the vital necessity of including PLANNED WIRING IN EVERY POSTWAR PLAN!

THE IMPORTANCE

Obviously, more and better wiring will have to come *ahead* of tomorrow's more efficient industrial production . . . city improvements . . . new products . . . finer appliances . . . more livable homes. The wider the recognition of this, the better business for everyone . . . utility, contractor, wholesaler, manufacturer.

And now—in advance—is the time to lay the foundations. Postwar planning is gathering momentum. *Unwired* planning will benefit no one. *Planned wiring* will help everyone. 44227

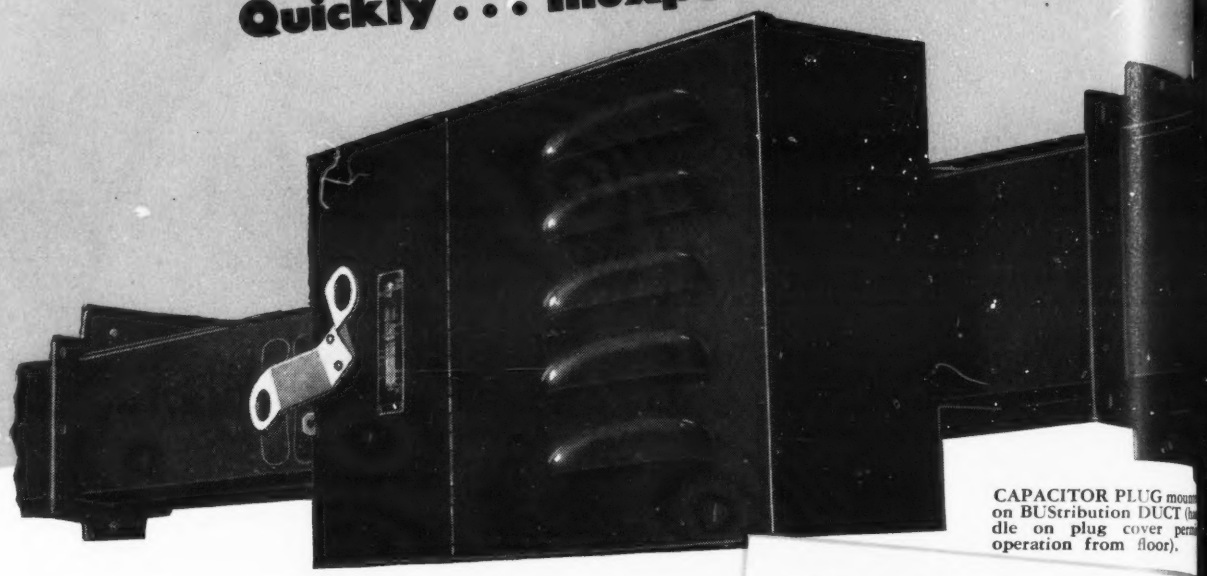
ANACONDA

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

IS YOUR POWER SYSTEM OVERLOADED?

Do You Want More Capacity . . . Quickly . . . Inexpensively?



CAPACITOR PLUG mount on BUStribution DUCT (ha dle on plug cover perm operation from floor).

Capacitor Plugs help in these ways!

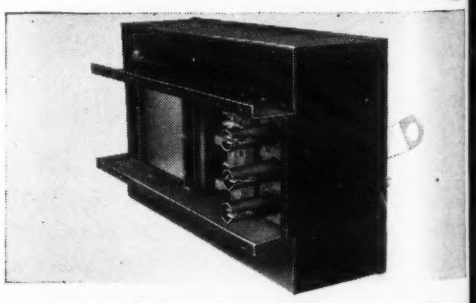
1. Inserted in any of the plug-in openings of your BUStribution DUCT, BullDog Capacitor Plugs increase the capacity of your electrical system by reducing the reactive KVA, thus ensuring lower operating temperatures and preventing needless fuse blows and production shutdowns.
2. They permit installation of Capacitors at the nearest point to your motors. As the load center shifts, the plug-in Capacitors can be shifted with it.
3. They represent a *decentralized,* and consequently more flexible, arrangement of Capacitors. Even if a unit should fail, the power factor correction of the entire system would not be affected, as it would with *centralized* banks of Capacitors.
4. They make possible the strategic location of Capacitors at the points in the system where poor power factor occurs, and this improves conditions for the rest of the equipment all the way back from the motors, through the bus duct, through the secondary switchboard, to the transformers.
5. Capacitor Plugs not only improve your power factor, but save valuable space and critical materials such as copper and steel . . . to say nothing of man-hours and production saved because of fewer blown fuses and greater operating efficiency.

BullDog field engineers are as close as your telephone for complete details . . . or write us direct.

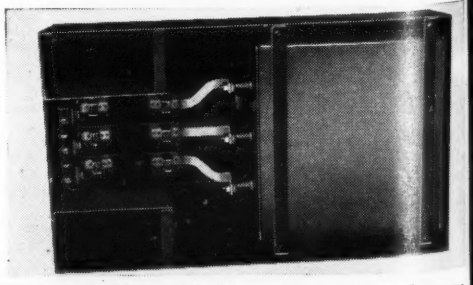
FOR A BRIGHT FUTURE BUY MORE WAR BONDS

New BullDog Capacitor Plug

You don't have to worry about space or supporting means for these Capacitors. Just plug them into the BUStribution Duct. It's as quick and easy as that! Rated from 1 to 15 KVA, complete with fusible switch or circuit breaker in one compact handy Plug for 230V or 460V 60 cycle.



Rear view of Plug showing bus contact fingers for plugging into openings along bus duct runs.

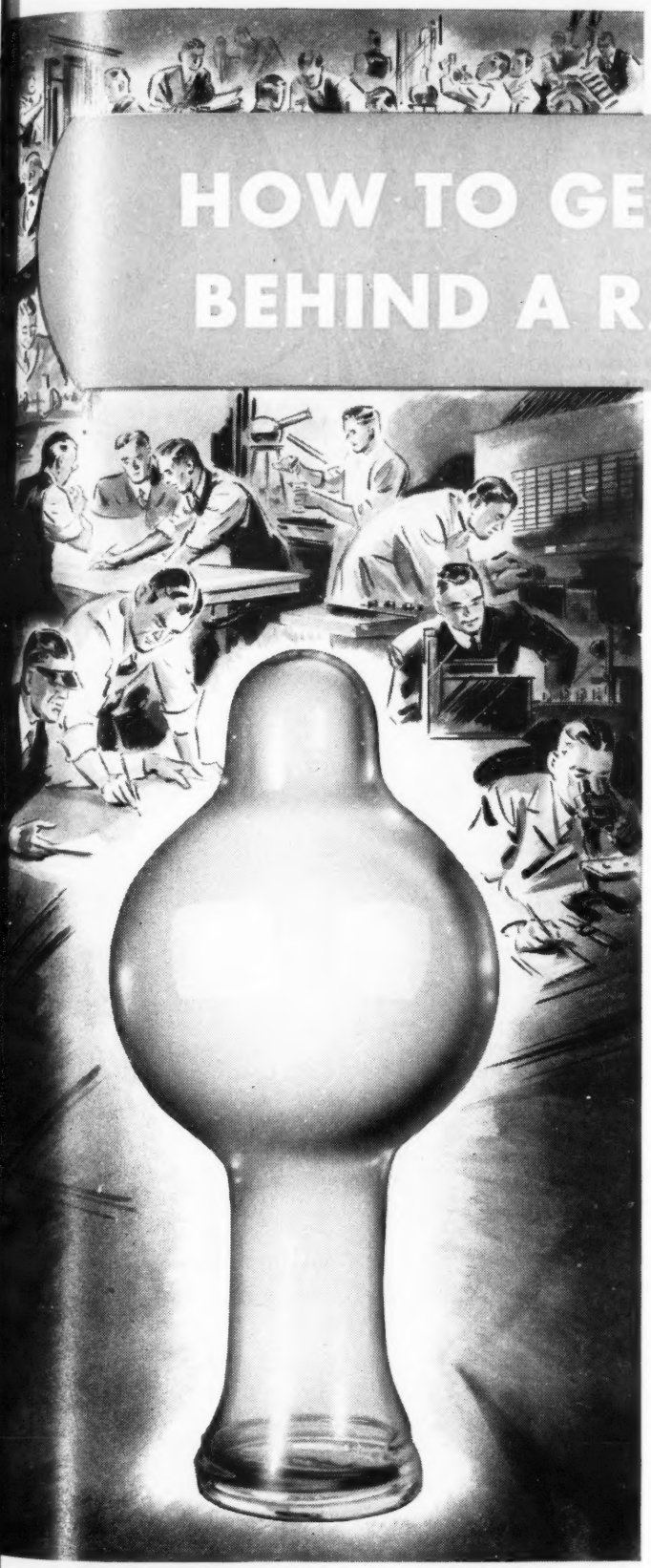


Capacitor Plug with front cover removed, exposing fusible disconnect switch and capacitor un

BULLDOG

ELECTRIC PRODUCTS CO.
Box 177, R. Pk. Annex, Detroit 32, Michigan
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

MANUFACTURERS OF a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Circuit Breakers and BUStribution SYSTEMS.



HOW TO GET 250 MEN BEHIND A RADIO TUBE

IT sounds like a big order—but we do it at Corning. And for any user of electronic glassware, big or little, this is a service mighty hard to equal.

Behind every radio tube, x-ray bulb, cathode ray bulb, resistor tube, every one of the hundreds of electronic glassware products made by Corning Glass—stand 250 glass experts. Planners, research workers, engineers, production men—each a specialist in his own right, backed by one of the largest, most modern laboratories in the United States.

This unmatched reservoir of glass-making experience is one of the factors which make Corning's position unique in the industry. In its 75 years of pioneering, for example, Corning has developed more than 25,000 glass formulae. It has made Pyrex brand heat resistant glasses a practical fact instead of a dream; it has developed glasses with an expansion coefficient practically equal to that of fused quartz, and which can be formed in a variety of intricate shapes which only recently were impossible in glass.

To the manufacturer of electronic equipment—Corning's "know-how" in glass is particularly important. It means that here, under one roof, you too can find helpful, expert advice on any glass problem. If you are interested in a detailed study of electrical glassware, write for "Glass in the Electrical Industry." Address Electronics Sales Dept. W-1, Bulb and Tubing Division, Corning Glass Works, Corning, N. Y.

CORNING *means* Research in Glass

Electronic Glassware

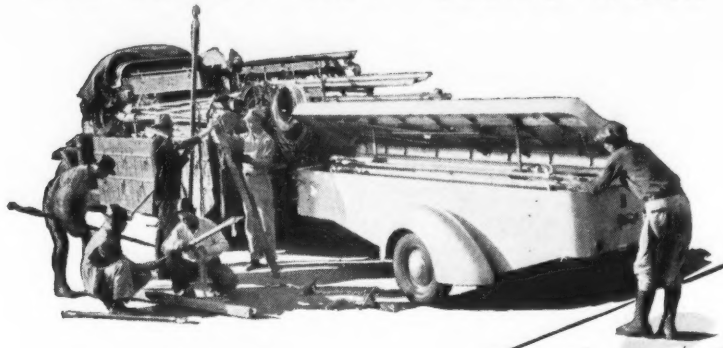
T.M.REG. CORNING U.S. PAT. OFF. T.M.REG. PYREX U.S. PAT. OFF.

"PYREX" and "CORNING" are registered trade-marks of Corning Glass Works

KEEPING POWER LINES WORKING
WHILE REPLACING
DEAD-END INSULATORS
ON A 33 KV LINE
By their skill and proper tools —these men prevent unnecessary shut-downs. Here a Kearney No. 4782 Utility Dead-End Tool is being installed on the structure preparatory to the removal of the dead-end string. In units of three discs or more the No. 7579 Insulator Cradle is recommended.
KEEPING POWER

MANUFACTURED BY THE **JAMES R. KEARNEY CORP**

THE BETTER THEIR "HOT" TOOLS
THE BETTER "HOT" CREWS WORK



LINES WORKING

with KEARNEY Hi-LINE TOOLS and ACCESSORIES

YOUR "Hot Crews" know that with better Hi-Line Tools they can do better jobs in keeping power lines working . . . whether in supplying vital continuity of service to Army, Navy or Maritime projects or to other defense or farm projects . . . They know, too, that with better tools, they can do better and safer jobs, whether in making emergency repairs—replacing insulators—pin or suspension type—straight line or dead-ends, changing crossarms or poles, or other such important jobs.

As pioneers in the manufacture and development of Hi-Line Tools and Accessories, the Kearney Corporation offers a complete line of hot-line equipment—tested, safe and fully guaranteed for particular jobs. As scores of hot stick gangs will tell you—Kearney puts out the best that money can buy . . . And any Kearney Representative will be glad to show you this equipment—or write for details.

FREE—TO YOUR HOT STICK GANG

Here's our offer to the boys who "work 'em hot"—to keep power lines working . . . a handy pocket-size booklet with 25 pages devoted to descriptions and illustrations of important hot jobs . . . a page of important safety hints . . . 60 pages showing modern Kearney Hi-Line Tools and Accessories . . . Get a supply for your "Hot Stick Gang" — FREE. Just write, today.

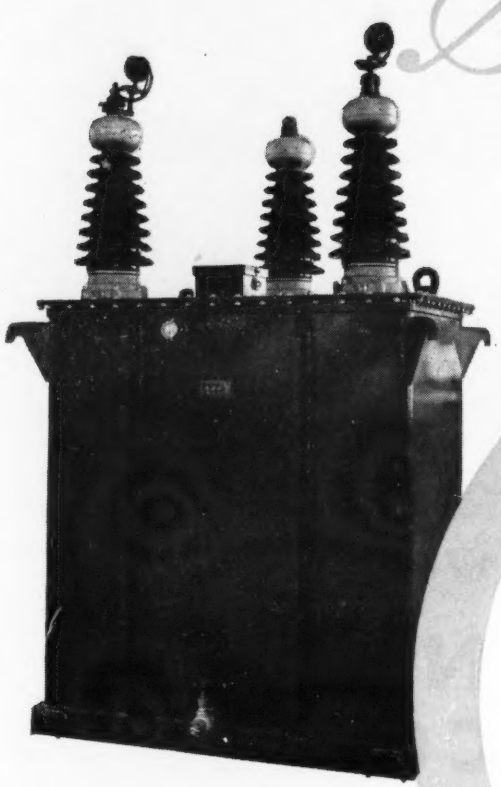
JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

4236 CLAYTON AVE., ST. LOUIS, MO.

The Mark of Quality Products

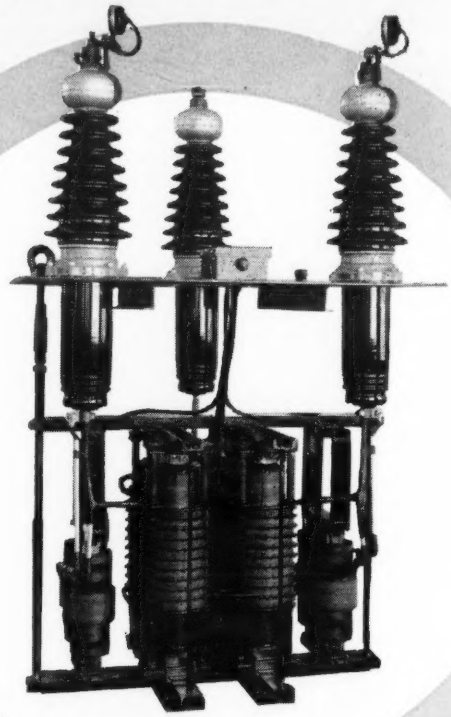
Standard

TRADE MARK

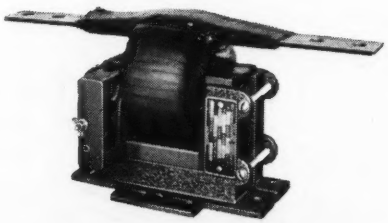


Outdoor, Oil Immersed Metering Set

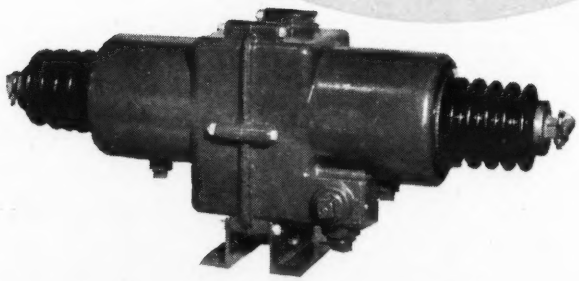
Consists of two Current and two Potential transformers mounted in an oil-filled steel tank. Shown here is the coil and core structure, also the complete set.



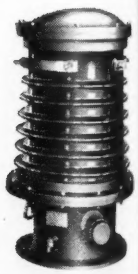
Current Transformers



For highest accuracy Standard type NA Current Transformers are used. Accuracy exceeds highest NEMA standard. Indoor service.



For outdoor service where high accuracy and dependability are required, the type CR transformer will give complete satisfaction.



This unusual, weather proof Current Transformer is porcelain housed. Type CWP for 46,000 volt service

For Every Class of Service

THE STANDARD

Distribution and Power · Current and Potential · Askarel Cooled

NSTRUMENT TRANSFORMERS

Current Transformers
Potential Transformers
Metering Sets

Meeting your most rigid requirements for accuracy and dependability, Standard Current and Potential Transformers and Metering Sets are made in many sizes and types to suit various service requirements.

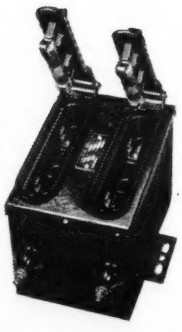
Current Transformers include types for indoor or outdoor use, in degrees of accuracy called for by requirements of the service, and for system voltages up to 69,000 volts (outdoor) and 15,000 volts (indoor). Liquid filled or air cooled dry type.

Potential Transformers are manufactured in sizes up to 69,000 volts (outdoor) and 13,800 volts (indoor). Liquid filled and dry types.

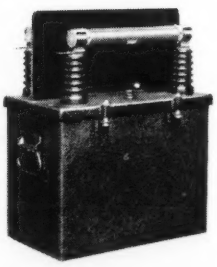
Standard Metering Sets provide primary metering service at considerable saving of space and cost. Made for outdoor service, for all voltages up to 69,000 volts, inclusive.

All Standard Instrument Transformers reflect years of experience and engineering skill in their design and construction. Users everywhere have found these Standard units accurate and dependable.

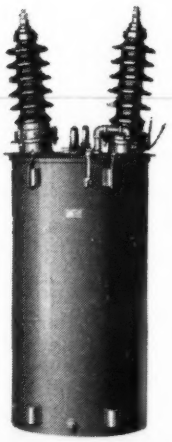
Potential Transformers



Type P Potential Transformers provide highest grade instrument or metering service. This type is for 2400 volts and below.



Standard Type P Transformer for 6,900 to 13,800 volt service. Both ratings are furnished with or without primary fuses.

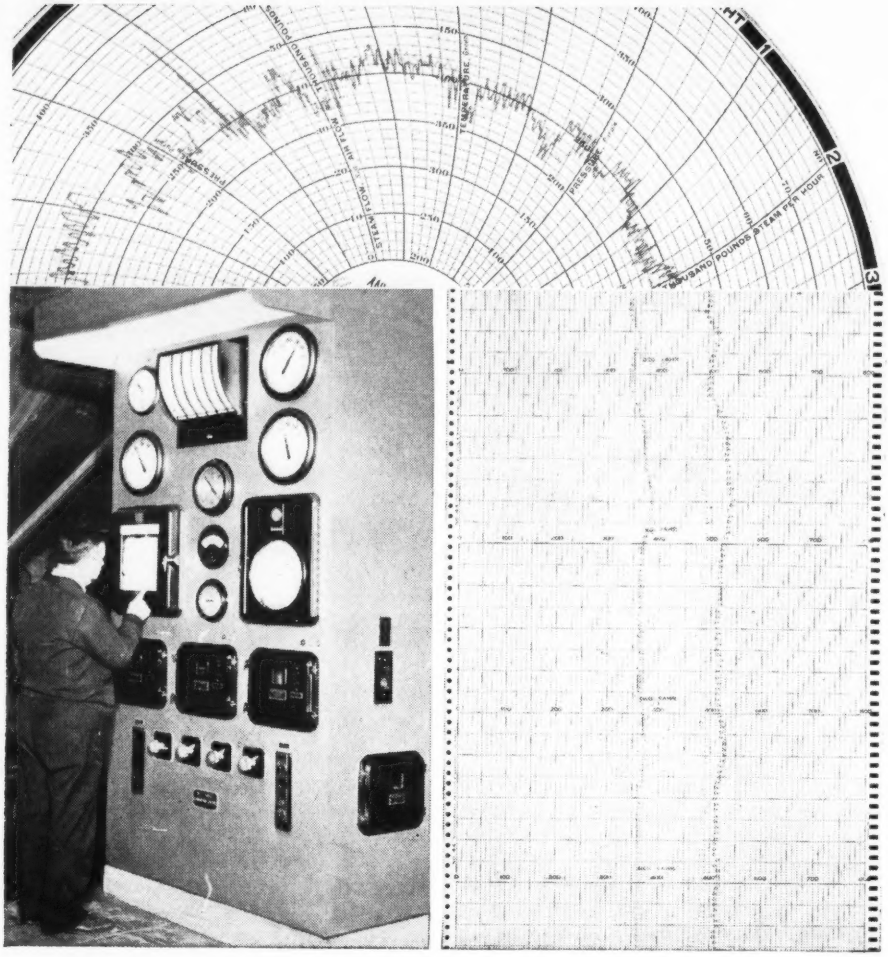


Typical oil-filled Standard Outdoor Potential Transformer. For service up to 69,000 volts. Air cooled in lower voltage class.

WRITE FOR ILLUSTRATED DATA BULLETIN

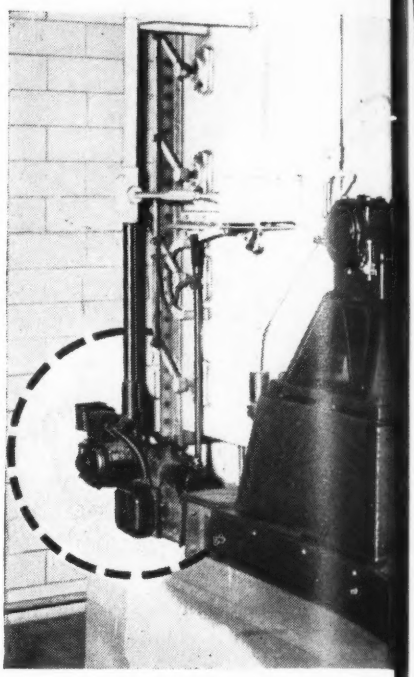
TRANSFORMER CO. WARREN, OHIO.

Rural · General Purpose Dry Type · Auto Transformers · Street Lighting



Top—Bleeding of turbines for process steam causes the swings shown on Utica Knitting Co.'s stoker-fired boilers.
Left—Boiler Panel with Metermax Combustion Control and Micromax Temperature Recorder.
Right—Typical section of Micromax Chart.

V depends on me!
A Slogan For Every American



Metermax-controlled Electric Drive Unit on inlet vanes of forced-draft fan.

HIGH BOILER EFFICIENCY?

Utica Knitting Co. Gets It With Metermax Combustion Control

Faced a few years ago with heavier demand for its products, the big Utica (N. Y.) Knitting Co. translated that demand into steam, took a careful look at its steam plant, and decided to install more capacity—at once. Out came some old boilers, up went a new building, and into it went a 50,000 lb/hr C. E. stoker-fired boiler, to supply 225 lb steam at 100 degrees superheat.

Prominent among the problems to be solved was, of course, how to operate this big unit? How to give U. K. Co.'s firemen the kind of help they would need with a boiler so totally different from the ones they were used to? How to operate this unit in parallel with their remaining older and much smaller boilers?

The answer is in the pictures herewith. Metermax Combustion Control has the flexibility that boiler operators need; any adjustment can be changed at any time; the unit can be returned partly or entirely to manual control by turning a single switch on the boiler panel.

And Metermax has the sensitivity needed for efficiency; the full sensitivity required for powdered-coal boilers in central stations is built into every Metermax.

Furthermore, Metermax is simple; its controllers are pneumatic-electric; and its drive units are entirely electric. No line shafting; no hydraulic or pneumatic lines; no connection between panel and drive unit except a single conduit run.

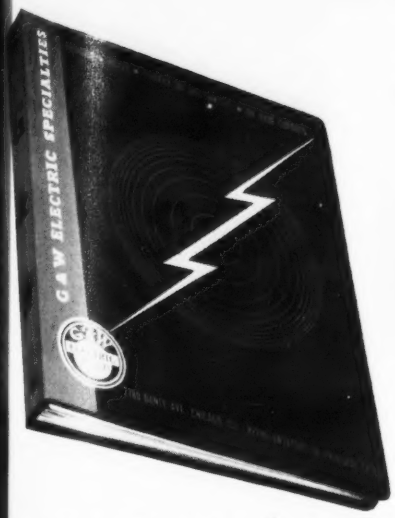
The Metermax Panel reaches you complete, ready for outside connection to fans, feeders, etc. We will if you wish assemble and mount all gauges, indicators and other accessories. We do excellent work of this kind!

If you have a boiler-control problem, outline it and an L&N engineer will gladly try to help. Or if a compact, fully-illustrated catalog will meet your needs, ask for N-01M-163.

TYPE P COMBUSTION CONTROL; COMPANION TO METERMAX

If your plant does not require the central-station characteristics of Metermax Combustion Control, we recommend Type P Control. It is simple, sensitive and thoroughly dependable. Ask for Catalog N-01P-163.

Jrl Ad N-01M-163(1)
LEEDS & NORTHRUP COMPANY, 4938 STENTON AVE., PHILA., PA.
LEEDS & NORTHRUP
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES



The G & W catalog binder is a valuable reference library because the data on equipment is detailed and accurate. It is easy to find what is needed.

Use the G & W catalog when laying out your plans and when ordering devices for your cable installations.

The current G & W catalog includes the following:

BUL. 392— **POTHEADS** and miscellaneous devices

BUL. DIP— **DIRECTIONS** for **INSTALLING** potheads

BUL. 403— **CABLE BOXES.**

BUL. 425— **TYPE "FC" OIL FUSE CUTOUTS**

BUL. 543—**TYPE "PK" & "PKL" SUBWAY OIL SWITCHES**

BUL. 643— **AUTOMATIC TRANSFER OIL SWITCHES**

BUL. 743— **TYPE "RA" SUBWAY OIL DISCONNECTS**

DISCOUNT SHEET No. 44.

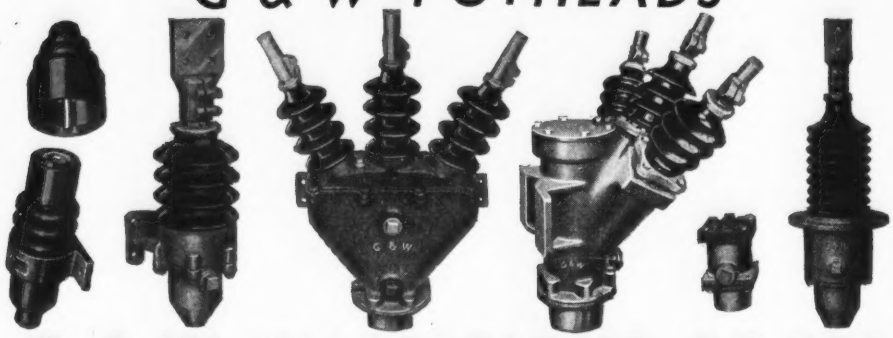
Let us help keep your G & W catalog up-to-date . . . send us your name for our mailing list. New bulletins and data sheets are sent from time to time to take care of new developments.

We are always glad to supplement the data in our bulletins with further information. You can secure special assemblies of standard parts to take care of unusual installations.

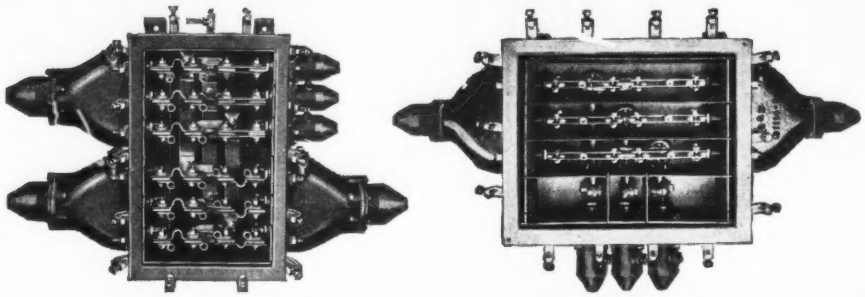
Call in our representative, or write

G&W ELECTRIC SPECIALTY CO.
7780 DANTE AVENUE
CHICAGO 19, ILLINOIS, U. S. A.
In Canada:
POWERLITE DEVICES, LTD. TORONTO

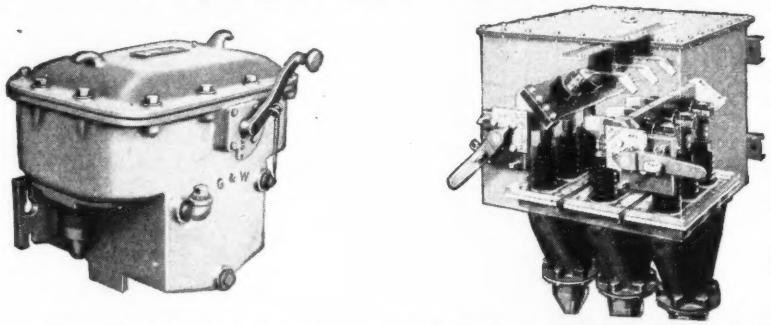
G & W POTHEADS



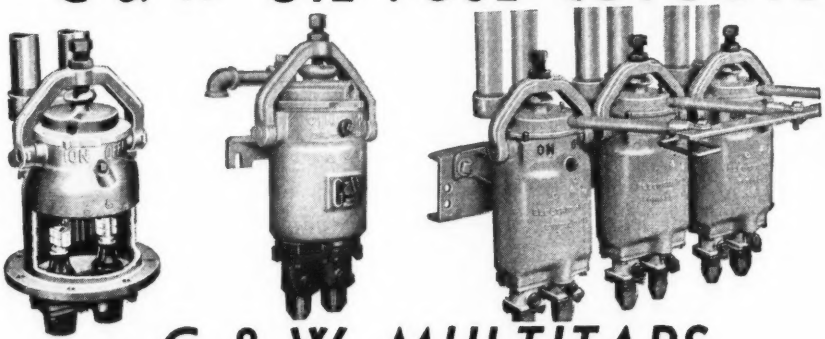
G & W WATERTIGHT BOXES



G & W SUBWAY OIL SWITCHES

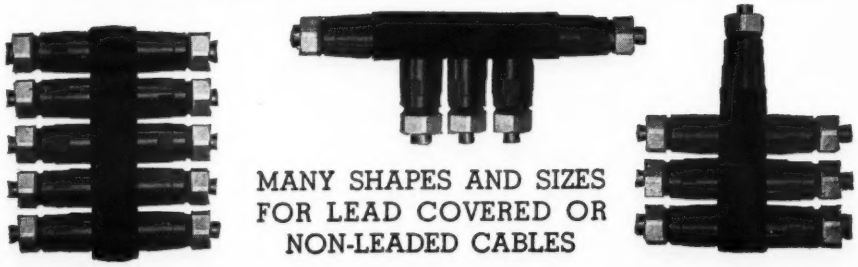


G & W OIL FUSE CUTOUTS



G & W MULTITAPS

TAPELESS, SOLDERLESS SPLICING DEVICE FOR SECONDARY CABLES



MANY SHAPES AND SIZES FOR LEAD COVERED OR NON-LEADED CABLES

THE FINAL TOUCH

ICING cup cakes from an electric range? No; sealing the parts in industrial lighting fixtures.

Today's industrial use of electrical power is at an all-time peak. To secure maximum output, prominent utilities are lubricating their turbines with Texaco.

Texaco Regal Oils keep turbine lubricating systems clean, assuring normal bearing temperatures and smooth, sensitive governor action. They separate rapidly from air and water. They are highly resistant to gum formation and sludging and *are rust and oxidation inhibited.*

Texaco Lubrication Engineering Service is available to you through more than 2300 wholesale distributing points in the 48 States.

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

* More revenue airline miles in the U. S. are flown with Texaco than with any other brand.
* More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.
* More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.
* More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.
* More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

TEXACO

REG. T. M.

TEXACO Regal Oils

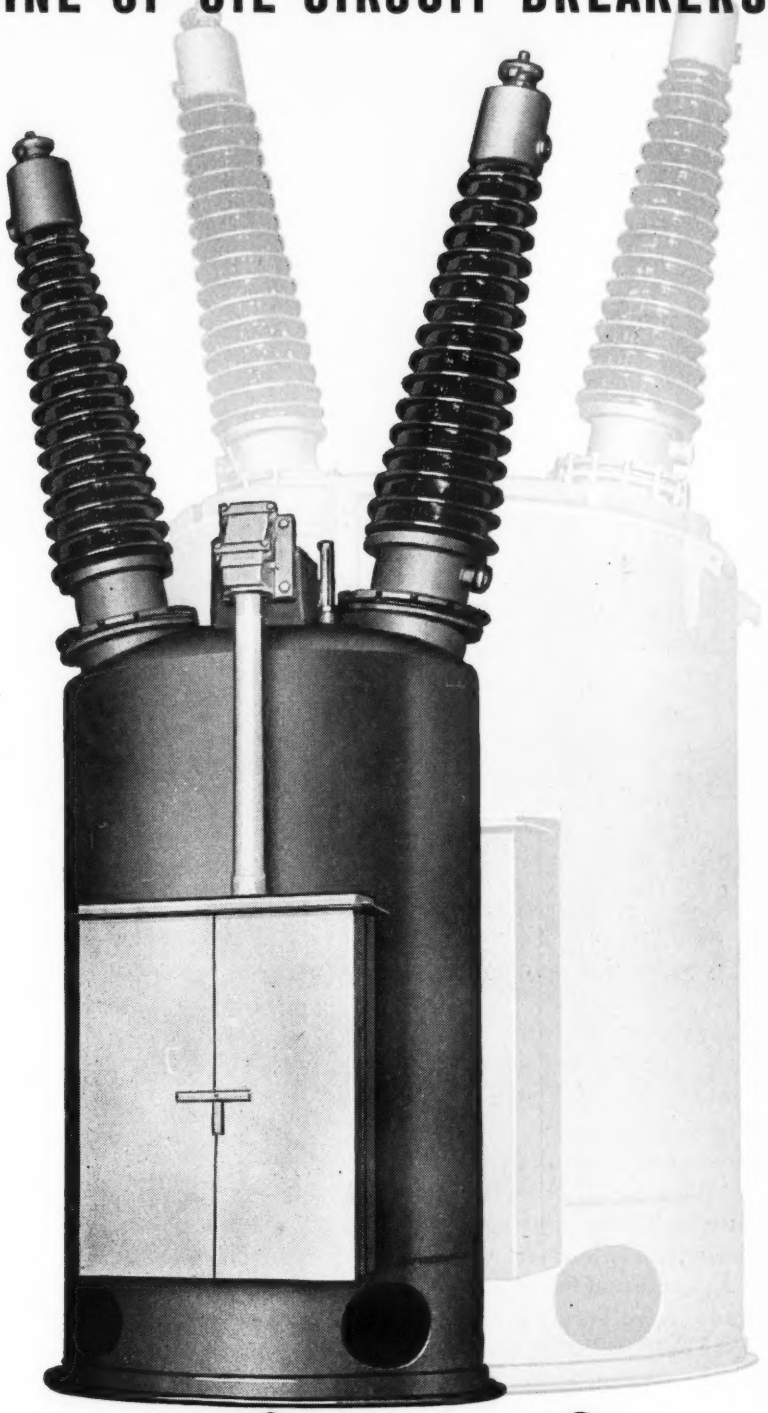
FOR ALL TURBINES

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

ANNOUNCING A NEW LINE OF OIL CIRCUIT BREAKERS

★
smaller size
★
faster opening
★
lower prices
★

...115 kv and above with 5 cycle opening time



To improve system stability on loaded, high voltage power lines, Westinghouse announces a new, smaller, faster opening, and lower priced GM breaker with 5-cycle opening time.

SMALLER than the 8-cycle breakers they supersede, these new breakers require less oil and oil handling and smaller foundations.

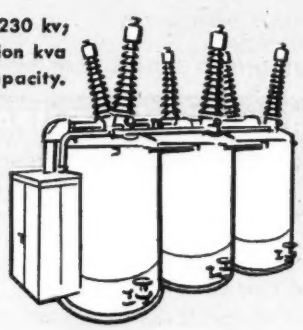
FASTER 5-cycle opening time on breakers 115 kv and above represents a standard feature long requested by users . . . it improves system stability.

LOWER PRICED than the breakers they replace, the new line represents the greatest breaker value ever offered by Westinghouse.

For complete information, call your nearest Westinghouse office. Or write Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa. Ask for bulletin DD-33-805.

J-60543

Ratings 115 to 230 kv; up to 3½ million kva interrupting capacity.



Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Circuit Breakers

4 NEW BRUSHES

Photographs Courtesy Boeing Aircraft

AFTER DETERMINING the cause of brush failure at high altitude on aircraft equipment, the Research Laboratories of National Carbon Company, Inc., discarded the practice of treating brushes by impregnation and developed a type of brush composition which produces a protective film on the commutator and assures satisfactory commutation and brush life under all service conditions—from take-off to ceiling.

As a result of tests in actual high altitude flights, four grades have been developed with characteristics that cover practically every type of rotating electrical equipment used on aircraft. Although designed primarily for operation at the low temperature, low humidity and rarefied atmospheric conditions of high altitude, these brushes also show highly satisfactory performance under comparatively high temperature and high humidity conditions at sea level.

GRADE AJS — A specially bonded graphite grade for high altitude operation on medium and high voltage commutators of dynamotors, 30-volt motors and other aircraft equipment not subject to excessive temperature conditions. This grade has fairly high contact drop.

GRADE AJZ — A graphite grade containing 25% copper adapted to high altitude operation on aircraft motors, interpole generators and similar applications. The contact drop of this grade is lower than that of Grade AJS.

GRADE AJT — A high altitude metal-graphite grade containing 50% copper and with low contact drop, it gives excellent service on 30-volt aircraft equipment such as motors, amplidynes, inverters, low voltage commutators of dynamotors, interpole generators and slip rings. Used at current densities ranging from 160 to 200 amperes per square inch.

GRADE ALP — A metal-graphite grade with approximately 63% copper and very low contact drop, for low voltage dynamotor commutators on which brush performance is affected by high altitude and because of the need for a grade of still lower contact drop than AJT.

These brushes have been developed for military aircraft. Both now and after the war, the research facilities of National Carbon Company will continue pre-eminently qualified for solution of brush problems imposed by the unceasing development of all types of rotating electrical equipment.

★ *BUY UNITED STATES WAR BONDS* ★

NATIONAL CARBON COMPANY, INC.
Unit of Union Carbide and Carbon Corporation
UCC
CARBON PRODUCTS DIVISION, CLEVELAND, OHIO
General Offices
30 East 42nd St., New York 17, N. Y.
Branch Sales Offices
New York, Pittsburgh, Chicago, San Francisco

1,500,000 POUNDS ON THIS PORCELAIN TEACUP.

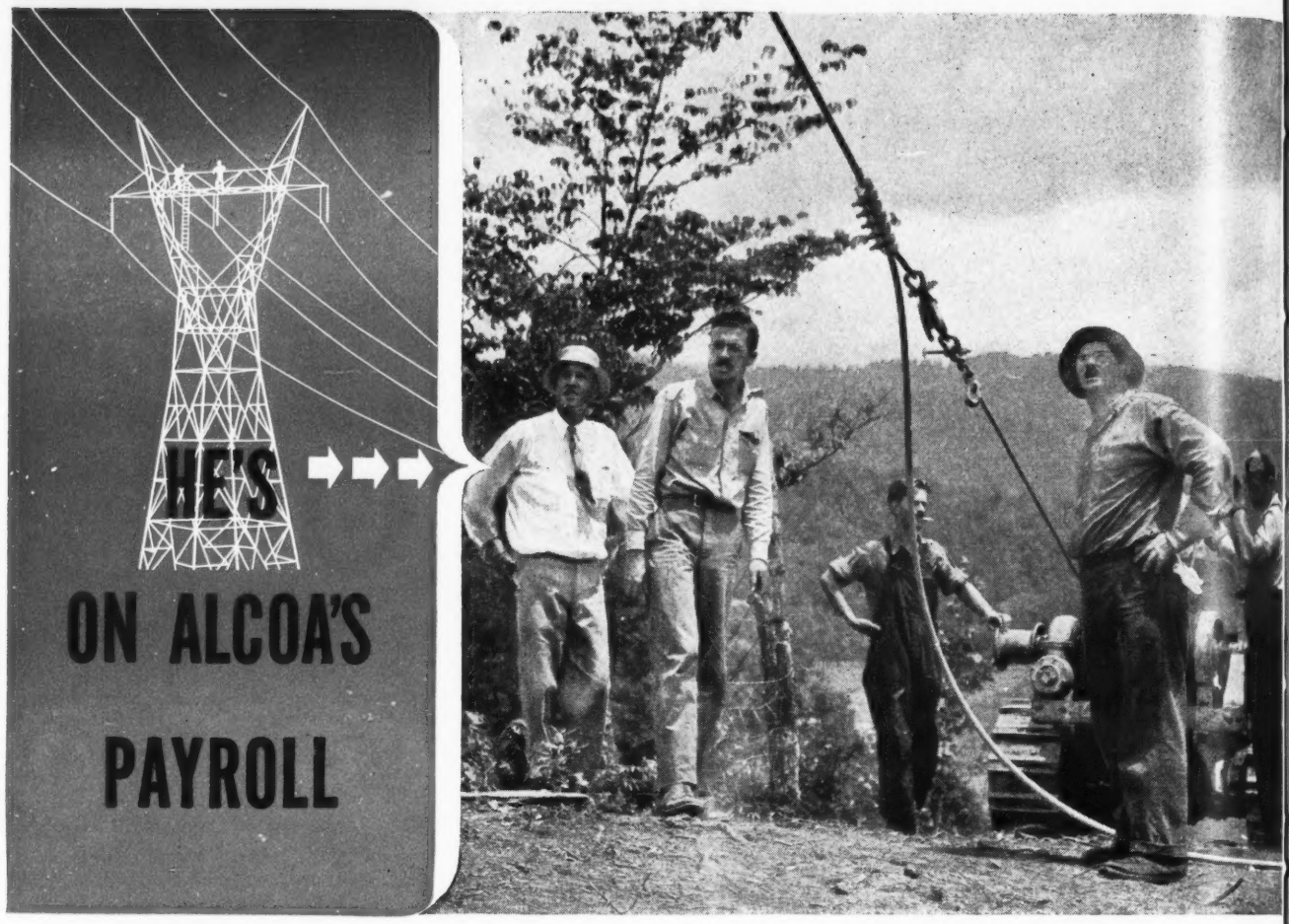
Base insulators of this type, built to support, on a single point, guyed radio masts as high as 1,040 feet, must withstand a routine proof test of 1,500,000 pounds. In laboratory test they have not failed at 3,000,000 pounds. Mechanical — and electrical — strains of this order are never imposed on transmission insulators; yet the same porcelain, the same engineering talent, the same manufacturing methods go into the least spectacular of Lapp products. Lapp insulators on your lines merit your confidence. Because they are made from *better porcelain*, they are *better insulators.*

Lapp Insulator Co., Inc., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators



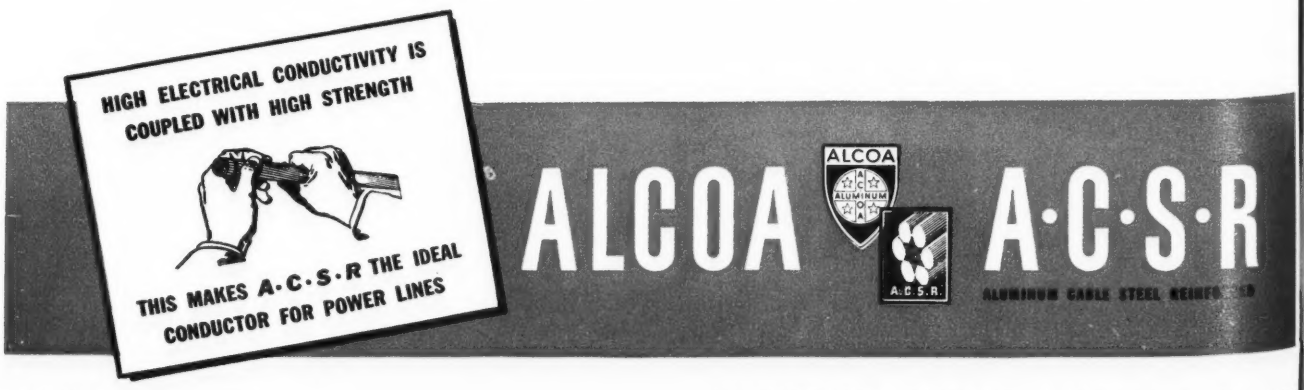
This A.C.S.R. line would doubtless have gone up just as well without this Alcoa supervisor on the job. But the power company's construction boss felt the need for him, so there he was.

He and the other Alcoa supervisors have been hard at work all during the war. In their advisory capacity, they've helped extend and prepare existing lines to meet added demands for war production. They have aided during storm emergencies and in securing badly needed materials. They have assisted in curing vibration troubles on all kinds of lines. (Stockbridge dampers play no favorites; they work on any conductor.)

This is service which Aluminum Company of America has always extended to users of A.C.S.R., during the many years Alcoa has been making aluminum conductors. It is service which will be continued.

When you order Aluminum Cable Steel Reinforced, specify ALCOA A.C.S.R.

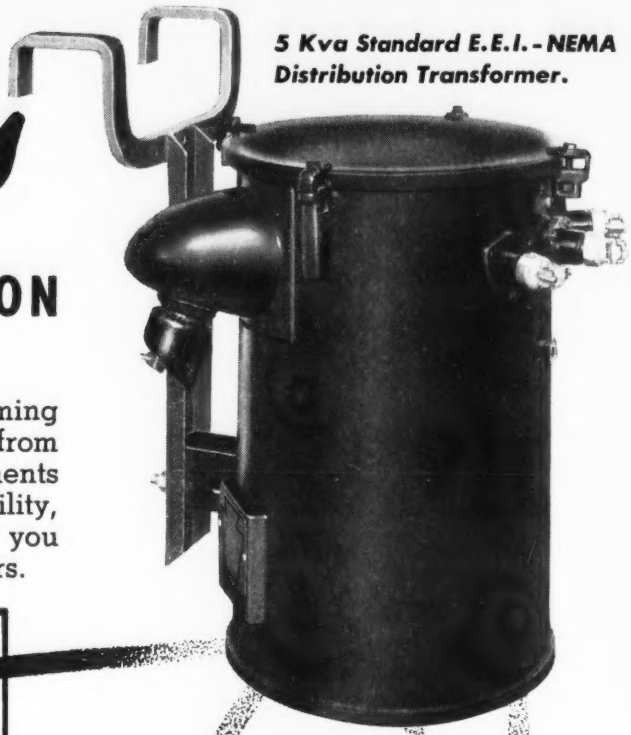
ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.


HIGH ELECTRICAL CONDUCTIVITY IS COUPLED WITH HIGH STRENGTH
THIS MAKES A·C·S·R THE IDEAL CONDUCTOR FOR POWER LINES
ALCOA
A·C·S·R
A.C.S.R.

4 Reasons

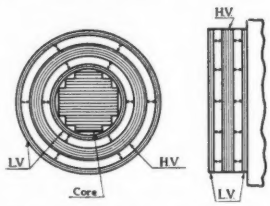
FOR SPECIFYING PENNSYLVANIA DISTRIBUTION TRANSFORMERS

Pennsylvania Distribution Transformers conforming to E.E.I.-NEMA Standards are available in sizes from 1½ Kva to 100 Kva. The fundamental improvements outlined below assure greater transformer reliability, lower operating costs and longer life. It will pay you to specify Pennsylvania Distribution Transformers.

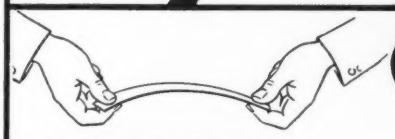


5 Kva Standard E.E.I.-NEMA Distribution Transformer.

1 CIRCULAR COILS FOR MAXIMUM STRENGTH & BALANCED STRESSES

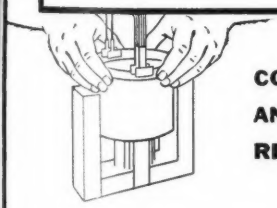


The turns in a circular coil are wound tightly with a safe uniform tension throughout the length of the wire. This eliminates the possibility of stretching the wire and injuring the insulation. The circular shape protects the coil against deformation due to radial short circuit forces. Tendency for vertical movement in the windings is eliminated by balancing the primary and secondary windings of the coil in the axial direction.



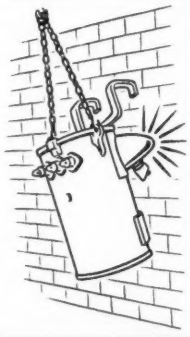
2 LOW TEMPERATURE IMPREGNATION LEAVES INSULATION PLIABLE

Coils are thoroughly impregnated in a special insulating varnish and cured at a maximum temperature of 105°C. This low temperature impregnation eliminates brittleness in the insulation and leaves it safe and pliable.



3 COIL EASILY AND QUICKLY REMOVED FROM CORE

Core and coils are not impregnated as a unit. The coil can be removed from the core by a simple operation — loosening two bolts and removing the top yoke laminations. All this can be done in a very few minutes with perfect safety to core and coils.



4 LARGE POCKETS PROTECT HIGH VOLTAGE BUSHINGS

Large, bullet-shaped pockets protrude beyond the bushings and protect the porcelain from injury while the transformer is being shipped, stored or delivered.

WRITE for our Catalog No. 142

Pennsylvania TRANSFORMER COMPANY
PITTSBURGH, PENNSYLVANIA

Pennsylvania TRANSFORMERS

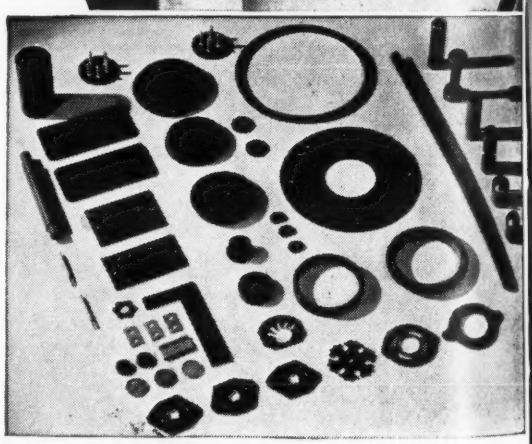
BEHIND all of our modern methods of communication are electrically energized devices. Their successful operation depends on good insulating materials, insulating materials that will take physical abuse and which will function under extreme moisture and temperature conditions.

Ever since electrical energy was first harnessed and put to work C-D materials have provided good insulation. The development of better insulating materials has been the constant goal of the C-D laboratory. The success of C-D's efforts have been the lengthening shadows which have forecast the phenomenal advances which this country has made in the field of communications.

1st DIAMOND Vulcanized FIBRE; then DILECTO, a moisture proof insulation; 3rd VULCOID, which combines to a remarkable degree the desirable properties of both DIAMOND Fibre and DILECTO; 4th MICABOND—Mica insulation in its most usable form and now DILECTENE, a pure resin plastic especially for U-H-F insulation.

C-D engineers have helped solve thousands of insulating problems. They have accumulated a wealth of "know how" which is at your disposal to help solve your electrical insulation problem.

DISTRICT OFFICES: New York • Cleveland • Chicago • Spartanburg, S. C. West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities



C-D products include THE PLASTICS... DILECTO—a laminated phenolic: CELORON—a molded phenolic: DILECTENE—a pure resin plastic especially suited to U-H-F insulation... THE NON-METALLICS, DIAMOND Vulcanized Fibre: VULCOID — resin impregnated vulcanized fibre: and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

CH-43

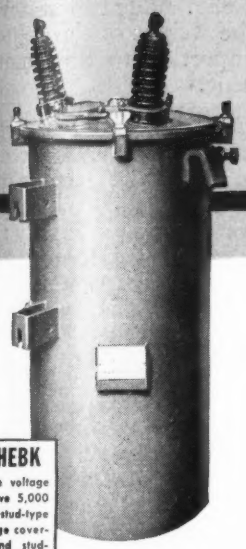
Continental - Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

Wagner

DISTRIBUTION TRANSFORMERS

are standardized in accordance with E. E. I. - NEMA Specifications



TYPE HEBK
Standard in voltage classes above 5,000 volts. Has stud-type high-voltage cover-bushings and stud-type low-voltage tank-wall bushings.

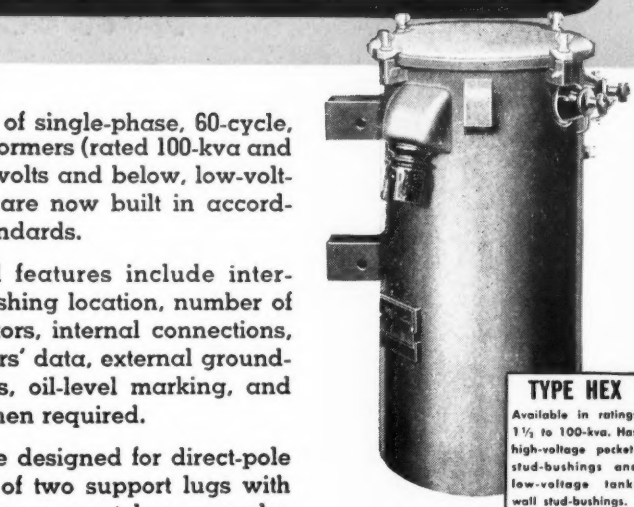
WAGNER'S complete line of single-phase, 60-cycle, pole-type distribution transformers (rated 100-kva and below, high-voltage 15,000 volts and below, low-voltage 600 volts and below) are now built in accordance with E.E.I.-NEMA standards.

Standardized mechanical features include interchangeable mountings, bushing location, number of bushings, terminal connectors, internal connections, nameplate and pad for users' data, external grounding provisions, drain plugs, oil-level marking, and terminal insulating caps when required.

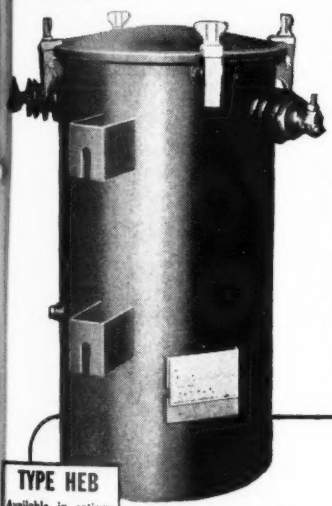
Ratings of 1½ to 50-kva are designed for direct-pole mounting through the use of two support lugs with standardized spacing. These support lugs are also used for attachment of "T"-crossarm hangers. Ratings of 75 and 100-kva have four support lugs for crossarm hangers, or accessory brackets for direct-pole mounting.

Stipulated electrical features include standardized high- and low-voltage ratings, kva ratings, polarity, low-voltage connections and taps.

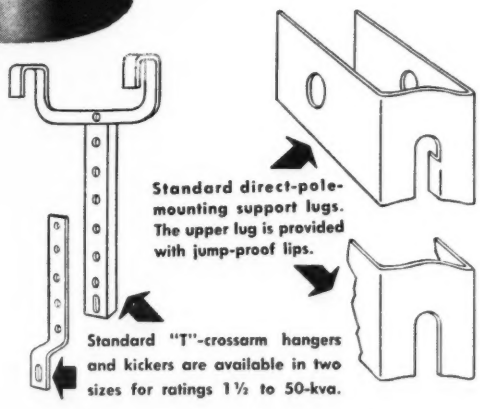
Illustrated are available types of Wagner distribution transformers.



TYPE HEX
Available in ratings 1½ to 100-kva. Has high-voltage pocket-stud-bushings and low-voltage tank-wall stud-bushings.

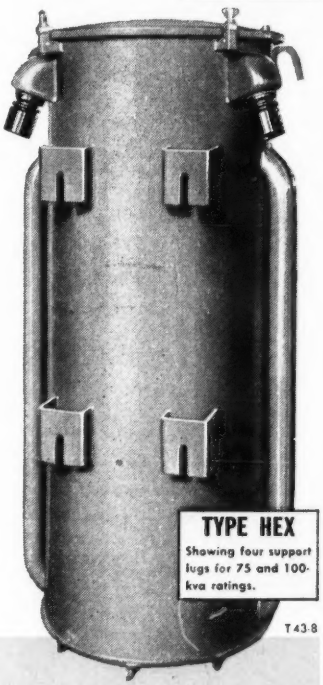


TYPE HEB
Available in ratings 1½ to 100-kva. Has sidewall-stud-type high- and low-voltage bushings.



Standard direct-pole-mounting support lugs. The upper lug is provided with jump-proof lips.

Standard "T"-crossarm hangers and kickers are available in two sizes for ratings 1½ to 50-kva.



TYPE HEX
Showing four support lugs for 75 and 100-kva ratings.

T43-8

COMPLETE INFORMATION WILL BE MAILED ON REQUEST

Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

Pure lead POSITIVES for Greater Conductivity

• Gould Plante positives are made from pure lead blanks that are reciprocated between high speed revolving discs. When the desired finely ribbed cross-section is attained each plate is then set in an electro-chemical bath, where its surface is converted to pure lead peroxide created from the pure lead plate itself.

Through this careful processing the entire plate becomes a potential source of active material, to be converted as service demands. The surface film of active material provides necessary capacity. As this wears away fresh lead is exposed, to be converted to new active material through the normal action of the cell.

Here's the point: One-piece pure lead construction with the active material made from the plate itself provides unfailing electrical contact. Since there is no mechanical contact a continuous circuit between the ribs and its central conductor is maintained. Thus maximum conductivity is assured at all times.

Get the facts on Gould Batteries. Ask for Gould Sealed-In-Glass Bulletin, using business letterhead.

Are you receiving the monthly informative "Gould Battery News"? If not . . . ask for it.

Rated conservatively . . . Goulds equal or exceed in capacity any battery of comparable size and cell structure.

GOULD STORAGE BATTERY CORP.
DEPEW, N.Y. • Factories at Depew, N. Y. • North Bergen, N. J. • Dallas
Atlanta • Chicago • Saint Paul • Leavenworth • Los Angeles

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

SPECIFIC GRAVITY

One of a series of service suggestions for users of industrial batteries.

▶ Specific gravity is the weight of a solution compared to an equal volume of pure water. On this scale pure water is one. Concentrated sulphuric acid normally has a specific gravity of around 1.835. Added to water it increases the weight of the solution in direct proportion to the amount of acid present.

For example, in a fully charged industrial truck battery, in good condition, this specific gravity reading is around 1.280, or 1.28 times as heavy as pure water . . . an arbitrary ratio of acid and water that has been found by research and experiment to be the most efficient for this purpose. When this same battery is in a discharged condition it will have a much lower specific gravity, for its electrolyte will contain less acid.

The reason for this difference is that the discharge of a battery is essentially a chemical reaction whereby acid from the electrolyte combines with the oxides in the plates to form lead sulphate. As this sulphate is created more and more acid is taken from the solution and that reduces its specific gravity. Charging operations reverse this action, driving the acid from the plates and back into the electrolyte. From this it is easy to see that a specific gravity reading, the ratio of the acid to water, is an accurate measure of a battery's state of charge.

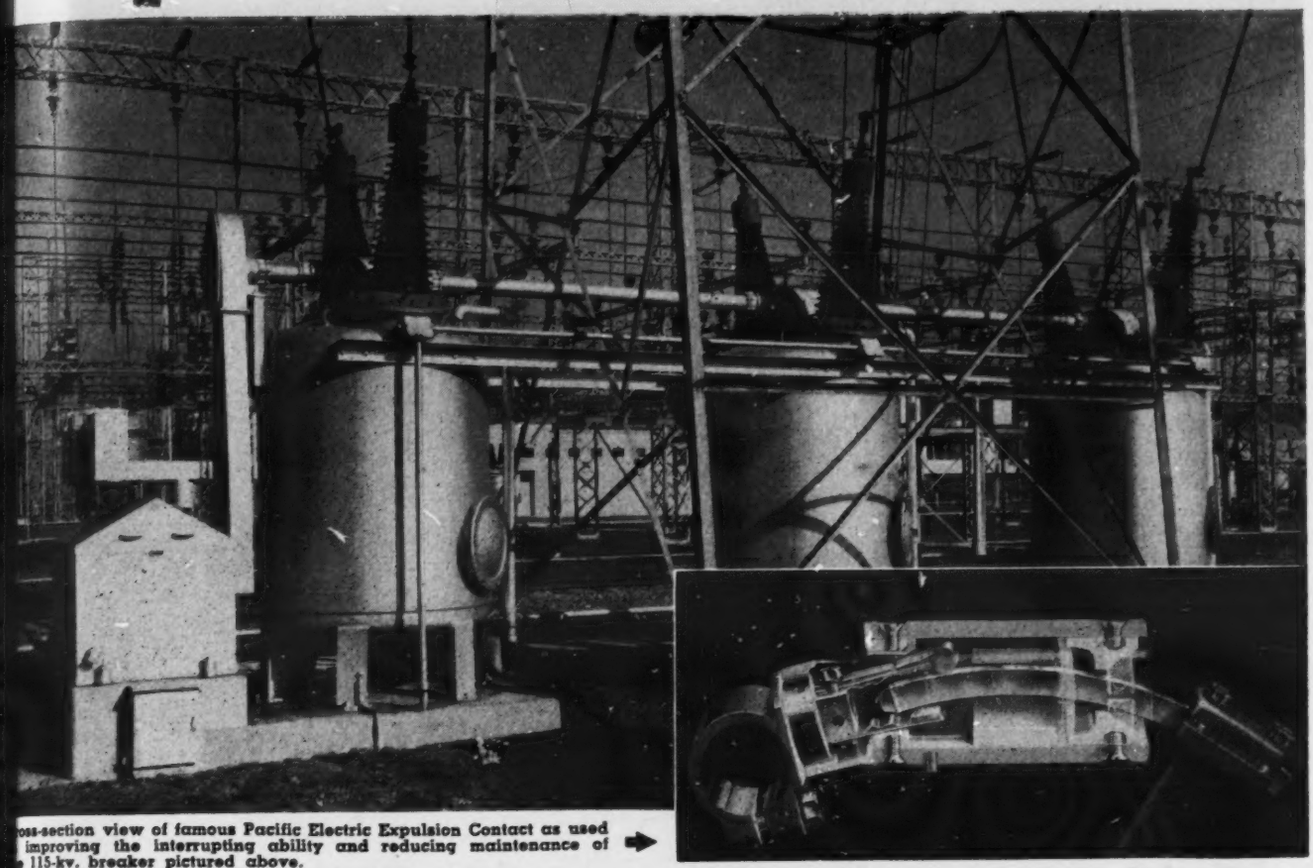
The use of a well designed hydrometer is the most convenient, and reasonably accurate means of ascertaining specific gravity. These hydrometers come in many styles and, in some cases, are built into the battery. For portable batteries, however, the commonest form is a syringe type that draws off a portion of the electrolyte into a glass tube containing the hydrometer.

The best of these hydrometers are accurate instruments. For reading they should be held so the eye is level with the surface of the liquid and the curvature due to surface tension disregarded. This is necessary because slight differences in the specific gravities of fully charged batteries can be an indication of trouble.

Interested persons may receive full information by writing the Service Department, Gould Storage Battery Corporation, Depew, New York.

(Advertisement)

Improve Old Breakers..



Cross-section view of famous Pacific Electric Expulsion Contact as used ➡ improving the interrupting ability and reducing maintenance of the 115-kv. breaker pictured above.

for MORE PROTECTION of WAR LOADS

HOW TO CLEAR FAULTS FASTER, IMPROVE INTERRUPTING ABILITY WITH *PACIFIC ELECTRIC* EXPULSION CONTACTS

Older Pacific Electric Breakers can be quickly modernized by the application of P.E. Expulsion Contacts — an exclusive feature of the modern P.E. Breakers which are nationally known for fast arc clearance, improved interrupting ability and lower maintenance.

By the addition of the Expulsion Contacts to older breakers your breakers will protect heavier loads at less maintenance.

With the resulting shorter tripping time, contacts last longer and oil carbonization is greatly reduced.

Ask us about the application of the P.E. Expulsion Contacts for improving the interrupting ability of older P.E. Breakers. Full details about this money-saving, time-saving, critical-material saving protection of war loads are available. All you need do now is tell us the number of Pacific Electric Breakers you consider improving, giving their sizes and serial numbers.

C. H. Cutter
1015 Securities Bldg.
Seattle, 1, Wash.

G. B. Kirkwood
427 S. Hill St.
Los Angeles, 13, Calif.

J. E. Redmond
448 W. Madison St.
Phoenix, Ariz.

C. C. Musgrove
508 Insurance Bldg.
Dallas, 1, Texas

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIANA

Twin Branch Station's new 120-cell Exide-Chloride Battery has a capacity of 400 ampere hours.

Exides were "a natural" for Twin Branch

When a 2500-lb. steam pressure addition was planned at the Twin Branch Station of Indiana & Michigan Electric Company . . . it was only natural that an Exide-Chloride Battery was specified, for the protection of electrical equipment.

They already knew the rugged dependability of Exide Batteries because, in the original station, an Exide satisfactorily handled all switching operations and provided an unfailing source of emergency lighting within the station.

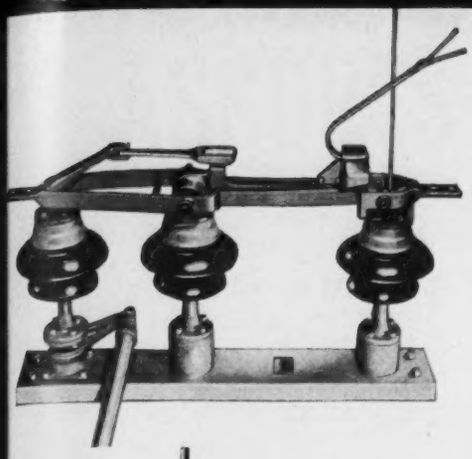
Today the duties of the new battery and the older one are co-ordinated. Under normal operating conditions one battery handles the circuit breakers and annunciators while the other takes care of a variety of jobs, such as steam valve controls, emergency lighting, emergency power for turning gear oil pump, emergency power for oil transfer pump, etc.

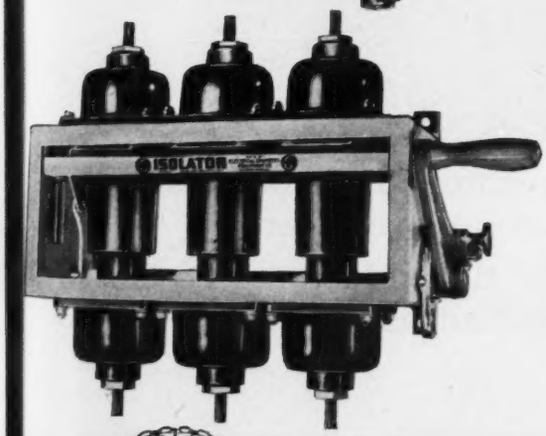
It's only natural for Twin Branch to stay with Exides. They're *built to last* and will *serve to win.*

Exide
CHLORIDE
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

"Three E" HIGH QUALITY LINE AND STATION EQUIPMENT





STRONG, PRECISION CONSTRUCTION for low cost flexible installations

• IF YOU COULD ROAM around the Country's largest power and sub-stations, industrial plants, Navy Yards, Army Bases, etc., you would find plenty of "THREE E" Switches, ISOLATORS, end bells, and other equipment rendering efficient service.

The reason is that "THREE E" equipment contributes many immediate benefits and will prove equally valuable when lines are extended and service facilities increased. Your "THREE E" equipment dollars secure FLEXIBILITY (all types designed to include this money-saving feature)—SAFETY (built into every unit)—SIMPLICITY (installation, operation, inspection all much easier and less costly)—ECONOMY (assured over longest periods).

In manufacturing our shops use only the best approved material, the latest machining and assembling methods, and a rigid system of inspection and tests. Consequently, when "THREE E" equipment leaves our plant we are confident that each piece will uphold a "THREE E" tradition of being the finest that money can buy.

The "THREE E" catalog gives complete information on all our products. It will be sent gratis to those actively interested in the application of high voltage switchgear.

Notable "THREE E" Achievement

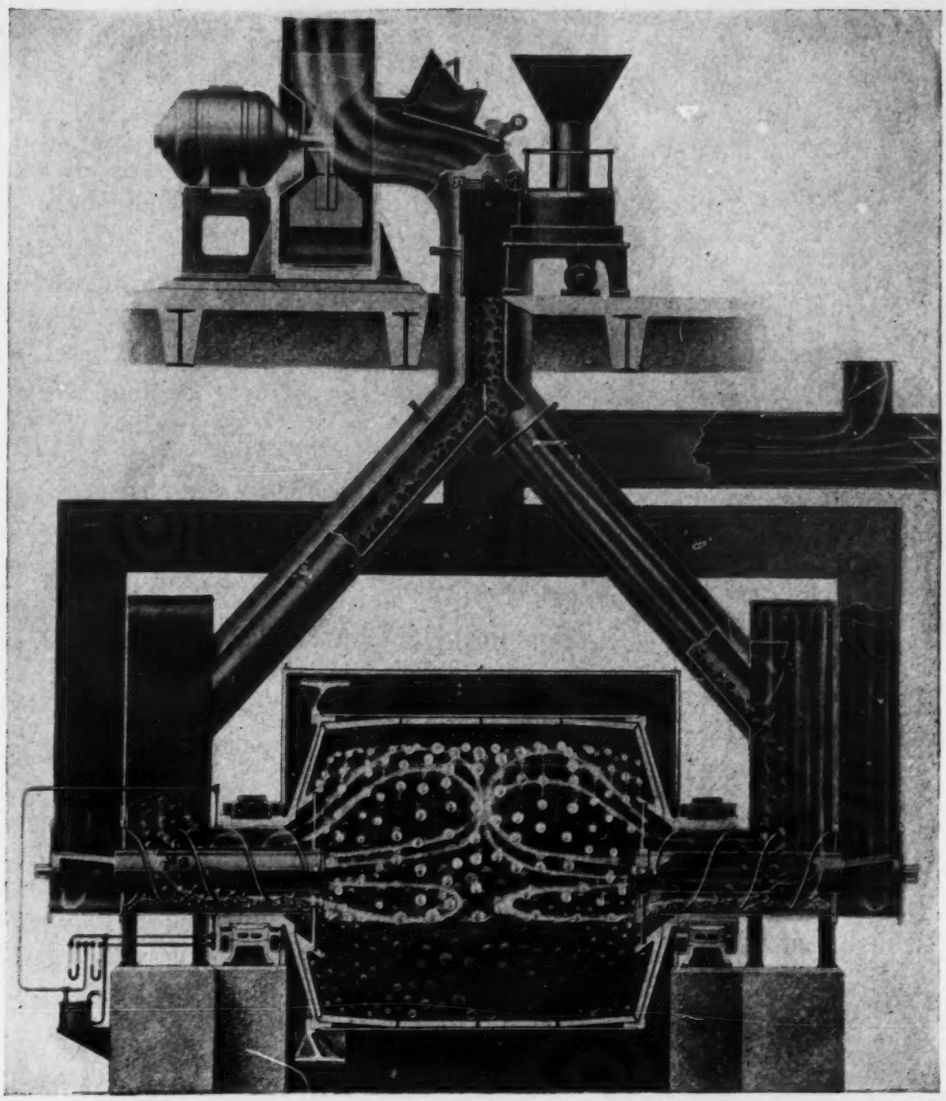
The ISOLATOR. It will pay you to get acquainted with this unique type of disconnect and load interrupting device. Ask for Bulletins No. 135 and No. 138.

•

THREE E

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

Continuous FINE GRINDING



Fine grinding and Full Capacity are obtained without dependence on close clearances between moving parts.

New Ball charge (the grinding medium) is added during operation as necessary, thus eliminating shut-downs to replace the pulverizing parts.

FW **FOSTER**

# of PULVERIZED FUEL ASSURES LOWER COST STEAM

The outstanding performance characteristic of Foster Wheeler (Hardinge type) Ball Pulverizers is maintenance of high fineness in the pulverized fuel—over long periods of service without loss in capacity.

This exceptional ability to operate without reduction in fineness or forced outage, effects material savings including:

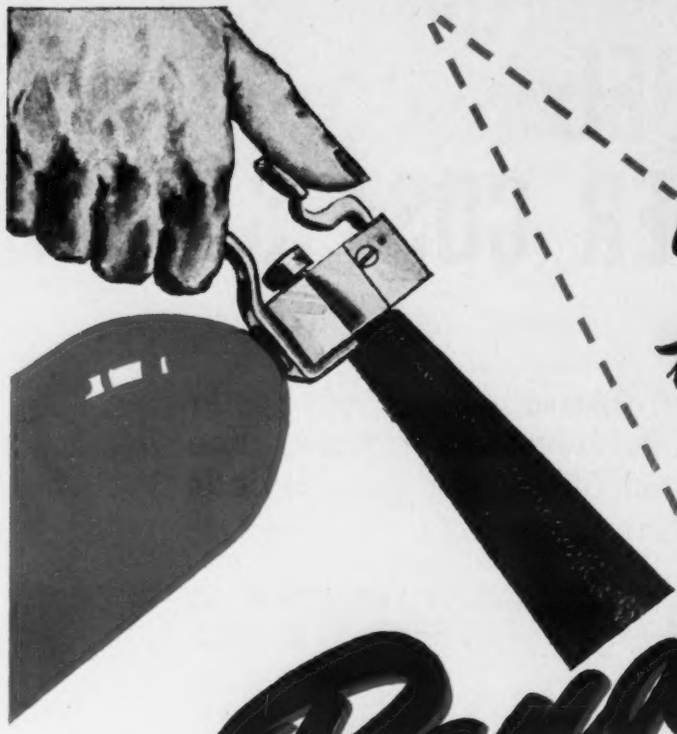
1. Boiler efficiency maintained for duration of run with resultant low cost for fuel.

2. Boiler outages for cleaning heating surfaces reduced; pulverizer repairs minimized.

3. Labor charges against cleaning boiler and water wall surfaces sharply decreased.

FOSTER WHEELER CORPORATION, 165 Broadway, New York 6, N. Y.

WHEELER FW



FREEZE that FIRE!

with the Randolph "4"

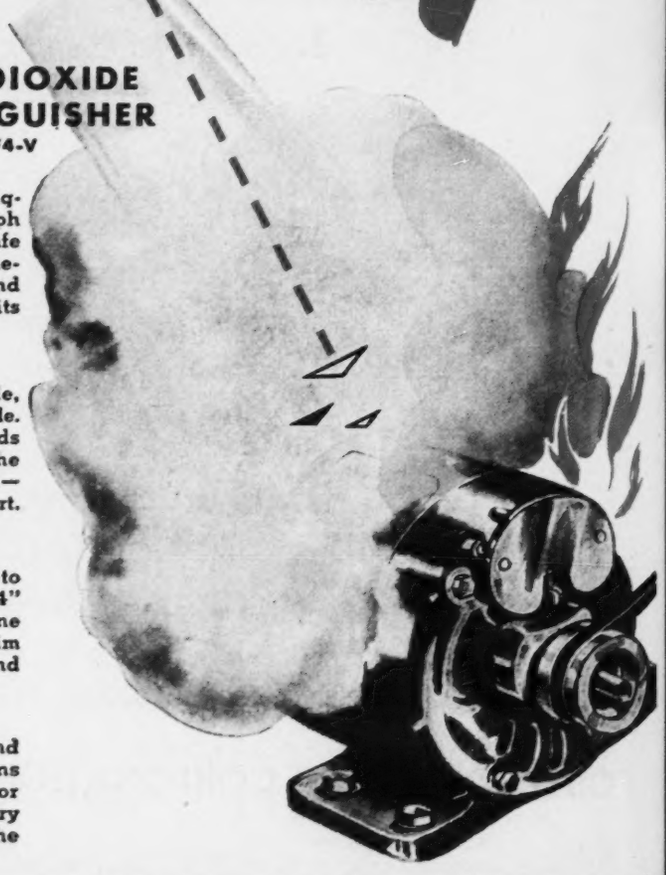
CARBON DIOXIDE FIRE EXTINGUISHER

Model FF4-V

The Right Extinguisher—For flammable liquids—motors—electric fires—the Randolph "4" carbon dioxide unit is the fast and safe extinguisher—instantly discharges a penetrating, icy blanket of gas that freezes and smothers the fire completely, preventing its spread and damage to material.

In The Right Place—Convenient, portable, light, the Randolph "4" is quickly available. Detaches easily from its wall bracket. Guards periodic work that is fire hazardous. The Randolph "4" provides positive protection—it gets to the fire before the fire gets a start.

Quick to Operate—No valves to turn, hoses to adjust, horns to swing up, the Randolph "4" is panic proof—aimed and operated with one hand—the rigid horn permits accurate aim and control—a touch of the thumb—and the fire is out!



Leaves No Trace—Randolph "4" carbon dioxide gas is clean and harmless—not a trace of deposit, stain or contamination remains to injure machines, affect electric motors, damage material or destroy chemical formulae. **Convenient to Get**—Prompt delivery to all essential industries. Your supply house probably has the Randolph "4." If not—write, telephone or wire—

RANDOLPH LABORATORIES, INC.

8 EAST KINZIE STREET • CHICAGO 11, ILLINOIS, U. S. A.

MULTIPLY LIMITED MANPOWER WITH FOUR-WHEEL-DRIVE *Hauling Power*

FWD TRUCKS HELP TO MAKE THE MOST OF AVAILABLE MANPOWER

When there's a bigger job to do—and fewer skilled men to do it—the performance of equipment assumes added importance. In maintaining vital power and communication lines, which are the nation's nerve system, more than 150 public utilities depend on FWD trucks, because FWD's enable line crews to do more work — faster. In any kind of going on and off the highway FWD's keep rolling, with least trouble and cost per mile. The full power grip of four driving wheels means better traction, and less strain on the chassis. That's one of many reasons why FWD's cover more ground and enable fewer men to get more work done.

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wisconsin

Canadian Factory: KITCHENER, ONTARIO

The True Four-Wheel-Drive Principle With Center Differential Asks Less in Gas • Oil • Tires • Replacements.

FWD TRUCKS

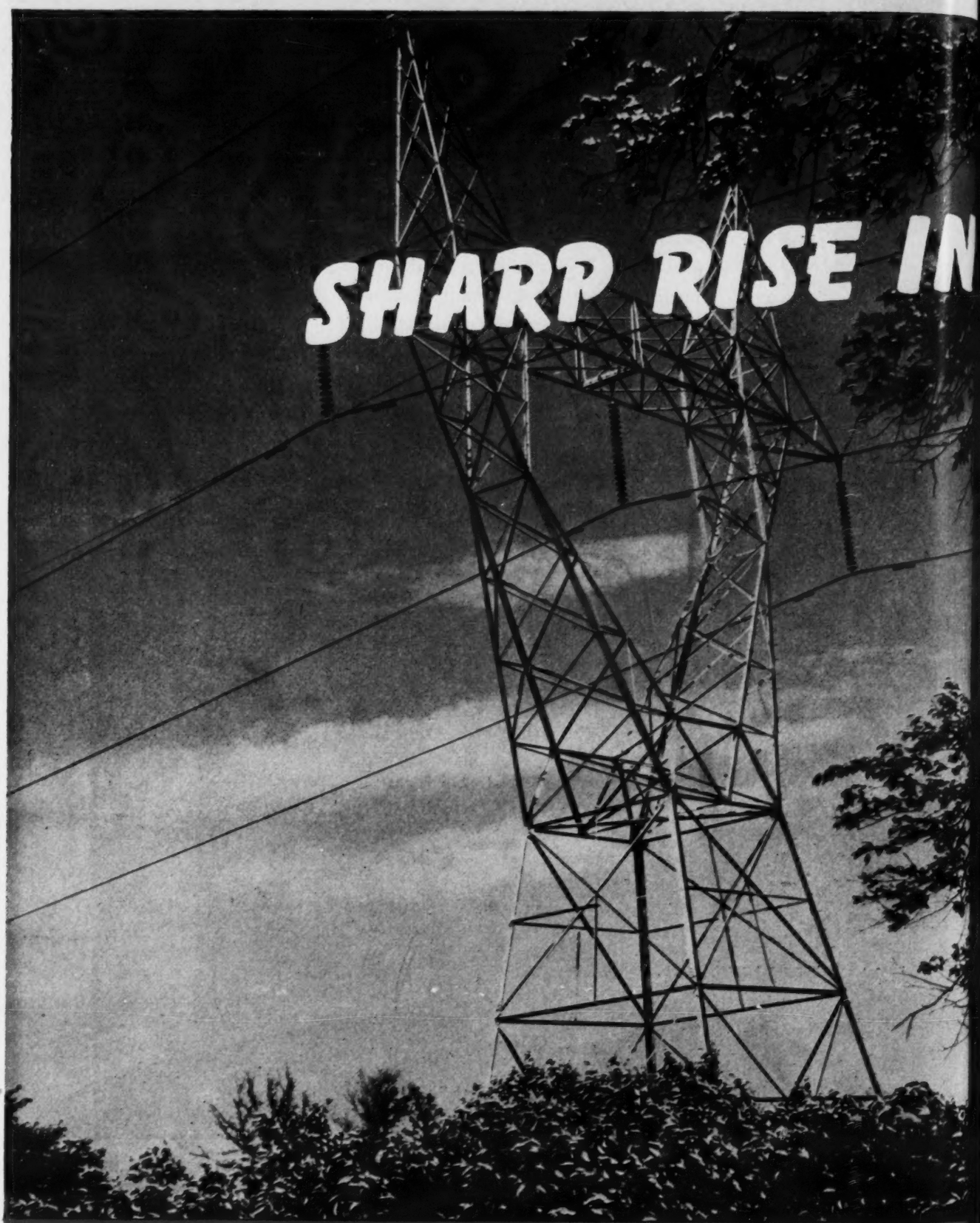
COMMERCIAL

CONSTRUCTION

UTILITIES

OIL FIELDS

MILITARY



C·E COMBUSTION

Canadian Associates: COMBUSTION ENGINEERING CORPORATION LIMITED, Montreal, Toronto, Winnipeg, Vanco

KILOWATT CAPACITY

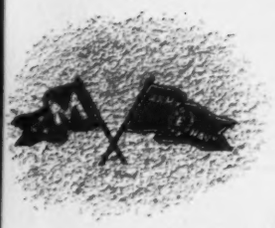
as total rated output of C-E Units placed in service in Utility Plants during first 10 months of 1943 exceeds

7,000,000 lb

of steam per hour

This steam output, expressed in terms of electrical energy, is the equivalent of *about half* of the entire new fuel generated kilowatt capacity placed in service in utility plants during the first 10 months of 1943—as reported by the Federal Power Commission.

The C-E Units which comprise this steam generating capacity—actually 7,270,000 lb per hr—span the complete range of utility requirements from 60,000 to 1,000,000 lb of steam per hr with pressures up to 1800 psi and temperatures to 955 F. A-771



ENGINEERING

200 MADISON AVENUE NEW YORK 16, N. Y.

Sixth of a series of statements about ETL *comprehensive services*

COMPREHENSIVE SERVICES IN PROMOTION OF GOOD QUALITY IN LAMPS AND LIGHTING

ETL operates widely in the lighting industry in cooperation with others in technical and engineering societies to extend the advantages of good lighting to the public in addition to efforts to make lamps and lighting equipment of best practicable quality. A considerable part of the ETL effort is engaged in promotion of good lighting practice.

One of the modes in accomplishing this is public certification of conformity with well-developed specifications. This, like all ETL services, is available to any and all whose products can qualify for certification.

Another means of promoting good lighting results is through the availability of ETL services to any and all producers and purchasers who may require technical assistance for the accomplishment of good results.

ELECTRICAL TESTING LABORATORIES, INC.
2 EAST END AVENUE AT 79th STREET, NEW YORK 21, N.Y.

PANCAKE WIREMOLD

QUICK and EASY WAY to make FLOOR SPACE more productive!

● Every plant, every office building, schools, laboratories, hospitals, constantly face problems of efficiently utilizing available floor space and frequent relocation of working units. Pancake Wiremold, the safe, simple OVERFLOOR Wiring System quickly takes care of required wiring connections . . . to desks, work-benches, appliances and machines . . . for work lights, telephone, control or signal systems. Uses minimum critical materials. Fast, easy installation . . . readily extended . . . connects to existing panels or wall outlets.

PHONE, LIGHT OR POWER OUTLETS . .

A few well designed standard fittings meet every requirement. Dangerous long extensions are eliminated, maintenance is reduced to a minimum.

INSTALLED WITHOUT DISTURBING WORKERS

Pancake, like other Wiremold Systems requires no channeling of floors or walls, can be installed without special tools, entails no pipe threading or waste. Slip joint connections are quickly made yet permanent, safe. Conforms to Federal Specification W-R-32; Listed by Underwriters' Laboratories.

Write for your copy of the Wiremold Catalog and Wiring Guide detailing this and other Wiremold aids to greater lighting and electrical efficiency.

The Wiremold Company, Hartford 10, Conn.

WIREMOLD CAN HELP YOU PRODUCE FOR WAR . . . AND PLAN FOR PEACE

The tool that replaces the torch...

IT'S the Burndy HYTOOL . . . the easy-to-use indenting pliers which *indent* Burndy HYDENT connectors to wires merely by closing the jaws. It makes a small wire electrical connection quicker, *surer and stronger*, than by any other method.

Burndy HYDENT connectors, are *one-piece, pure copper* connectors. Thus, when firmly indented to wires with the HYTOOL, they provide connections of *maximum conductivity*, that are *on to stay!*

For electrical maintenance, as well as in manufacture, you can *lower installation and servicing costs*, and *improve circuit efficiency*, by using the HYTOOL instead of the torch. Why not send for the new HYDENT catalog, today?

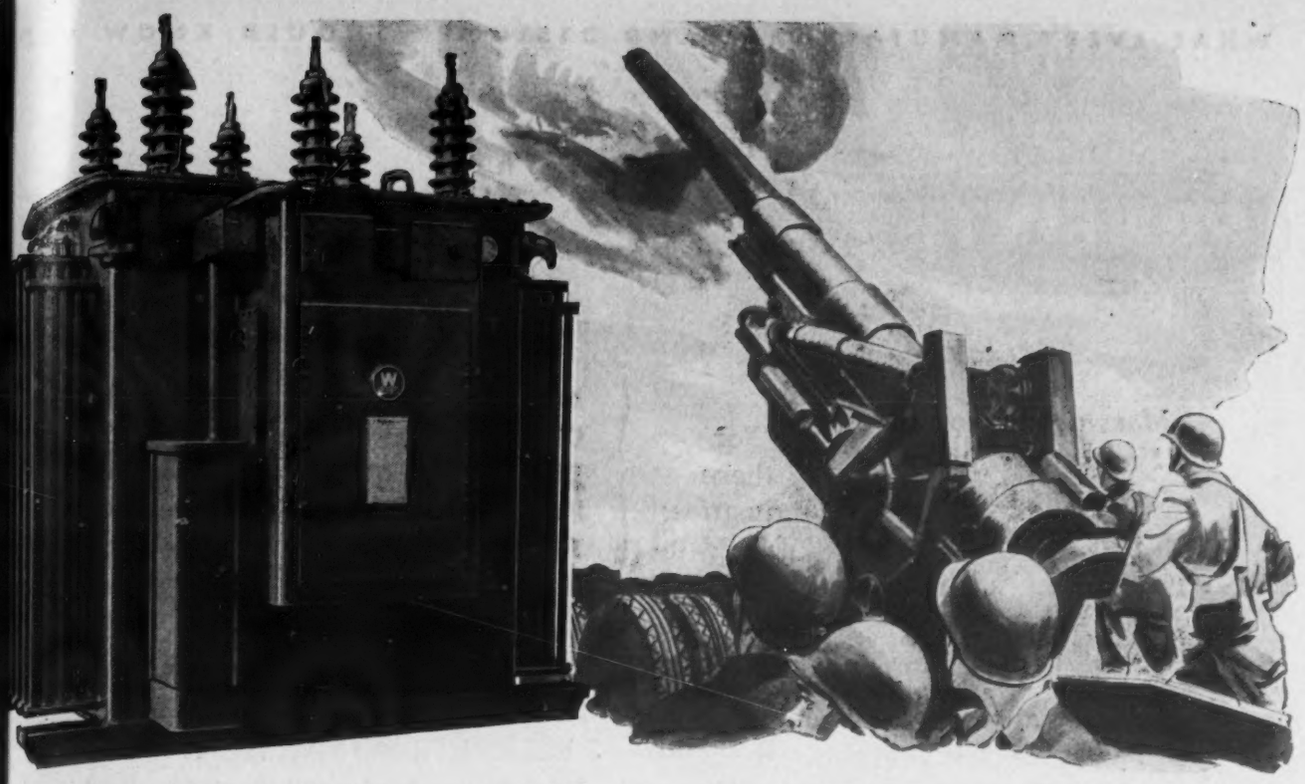
Burndy HYDENT Connectors are available for all wire and cable sizes from #30 to 2500 mcm . . . and in types for all connection problems.

Burndy Headquarters for CONNECTORS

BURNDY ENGINEERING CO., INC.
107 EASTERN BOULEVARD, NEW YORK 54, N. Y.

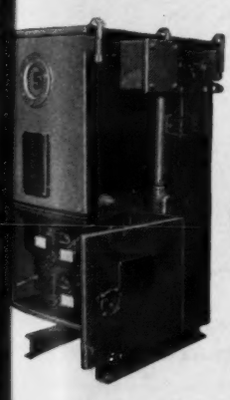
THE BURNDY INDE

. . . the mark of a sound and efficient electrical connection



Speeding shells to the firing front

stinghouse builds a complete
of feeder voltage regulators
ll types and sizes. Liquid-
d step and induction regu-
rs for indoor and outdoor
rice and natural air-cooled
ulator for indoor service.



Before arsenals can turn out guns and shells, electric power must be delivered over transmission lines—power to supply the increased demands for more production.

But new or parallel transmission lines and generating facilities demand large quantities of copper—the very material so vitally needed for guns and shells. To supply the power—and yet save these critical materials—is the ideal accomplishment.

In many instances, existing equipment is adequate if normal voltages can be maintained. Thus, important savings can be made in copper, other critical materials and valuable time. But benefits do not stop there; improved voltage conditions mean better lighting and more efficient motor operation.

Westinghouse voltage regulators are built in a complete range of types and sizes to meet every industrial need, large or small, indoor or outdoor. Complete information is available from your nearest Westinghouse representative. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Penna.

J-70417

WHY YOU NEED VOLTAGE REGULATION:

1—*Low Voltage Affects Motor Torque*—Motor starting torque drops off at a greater rate than actual voltage drop.

2—*Low Voltage Ups Motor Current Consumption*—Motors required to deliver rated output use more current if voltage falls off.

3—*Low Voltage Impairs Lighting*—Continuously good illumination depends primarily on proper voltage conditions.

4—*Low Voltage Interferes with P. F. Correction*—Any voltage drop sharply reduces the effectiveness of capacitors in correction of power factor.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Voltage Regulators

WHAT EVERY MANUFACTURER AND DESIGNER SHOULD KNOW ABO

PANELYTE* *the structural plastic*

Mass production of **Sheets, Rods, Tubes, Molded Forms, Fabricated Parts.**

For these Industries: **Automotive, Aviation, Central station, Chemical, Communications, Electrical Equipment, Maritime, Paper Mill, Petroleum, Radio, Refrigeration, Textile, Transportation.**

---

1 WHAT PANELYTE IS

PANELYTE is the trade name for a wide range of structural, laminated resinous plastics, produced in 32 grades, with paper, fabric, wood veneer, fibre glass, and asbestos bases.

2 WHERE PANELYTE IS USED

In the refrigerator, automotive, electrical and chemical industries, PANELYTE has long been one of the largest producers of molded and fabricated, electrical and structural plastic parts. Before the war, PANELYTE was also widely used in central station, communications, maritime, and paper mill equipment, as well as in the petroleum, radio, textile and transportation fields. Today the facilities of the greatly enlarged PANELYTE plant are enlisted in the war effort, serving principally the aviation industry and the various branches of the armed forces.

3 WHY PANELYTE MAY SOLVE YOUR PROBLEM

Originally thought of as an alternate for critical metals, designers and engineers have learned through experience that PANELYTE is instead a *unique* material *for which* there is no substitute. In addition to availability, PANELYTE reduces costs and assures greater efficiency and longer life.

4 PANELYTE ENGINEERS WILL WORK WITH YOU

Our engineering staff can quickly tell you whether or not PANELYTE is the material *best* suited to your needs. If a laminated structural plastic can improve your product, increase your production, save you money, simplify assembly, or aid the War effort *in any* way, the services of our seasoned engineers are at your immediate service. Data Sheets and samples are available.

* AMERICA'S LARGEST PRE-PEARL HARBOR PRODUCER OF THERMO-SETTING MOLDED LAMINATED PLASTI

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE, NEW YORK 17, N. Y.

Sales Offices: Atlanta, Chicago, Dallas, Denver, Detroit, Houston, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Toronto, Vanc

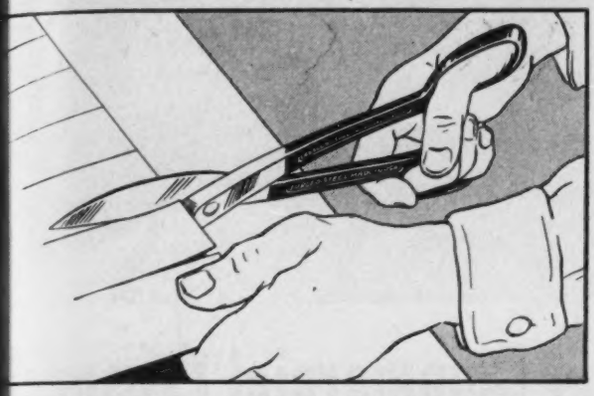
Experienced and reliable Fabricators in Industrial Centers from coast-to-coa

TOOL NOTES

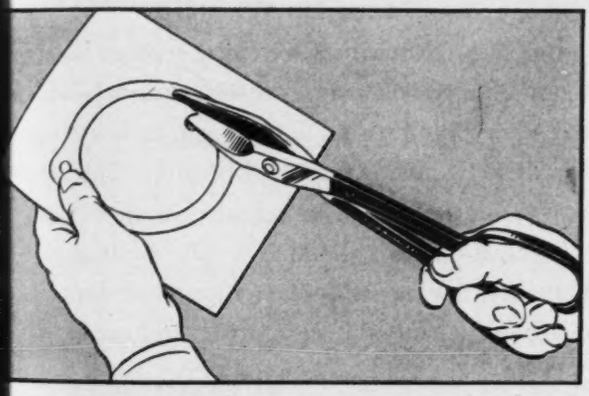
"How To Do It" Information For Crescent Tool Users

No. 17 . . . . PICKING THE PROPER TOOL FOR THE JOB

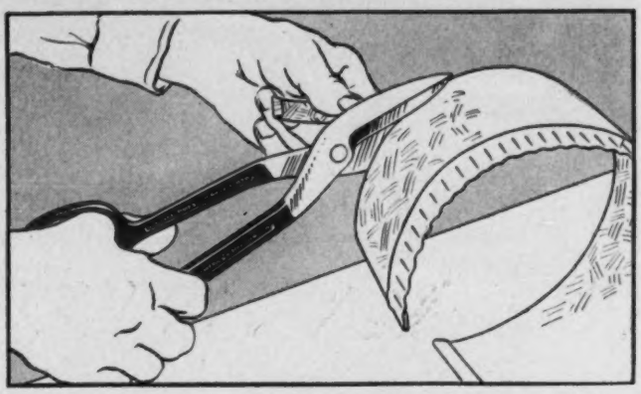
ere is a difference in snips. They vary in style and in order that they may better handle a wide range cutting work. Below are some common examples.



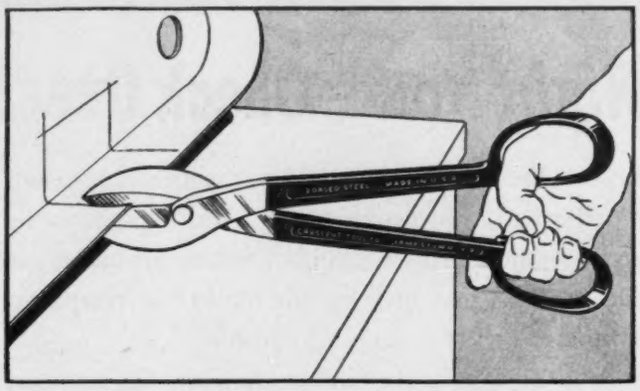
general cutting use, STANDARD PATTERN ESCENT SNIPS are recommended. Made in 8 s, they are designed to cut straight lines or circles fairly large radius. Example: Cutting sheet metal ize.



ere it is necessary to cut intricate patterns or curves small radius, use CRESCENT CIRCULAR CUT-NG SNIPS. The curved contour of their cutting es makes it possible to turn the cut sharply with-taking a new "bite." Example: Cutting intricate plates.



When "on-the-job" work will not permit an assortment of snips being carried, use CRESCENT COMBINATION SNIPS. They are designed after conventional circular cutting types and will cut curves as well as straight lines. Example: Hot air furnace work.



Where powerful leverage is necessary, as with heavy sheet metal, CRESCENT HEAVY DUTY SNIPS—with an overall length of 16¼ inches—are ideally suited. Example: Heavy bench work.

MAIL THE COUPON FOR FREE REPRINTS

This is No. 17, in Crescent's TOOL NOTES Series. These informative advertisements providing practical information for users of hand tools, are available either punched to fit a standard 3-ring binder or suitable for bulletin board and classroom use. Coupon request will receive prompt attention.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

CRESCENT TOOLS
Give Wings to Work

Crescent Tool Co., Jamestown, N. Y. H-4

Please send your "TOOL NOTES" Series

☐ for Bulletins ☐ for 3-ring binder

Name _____

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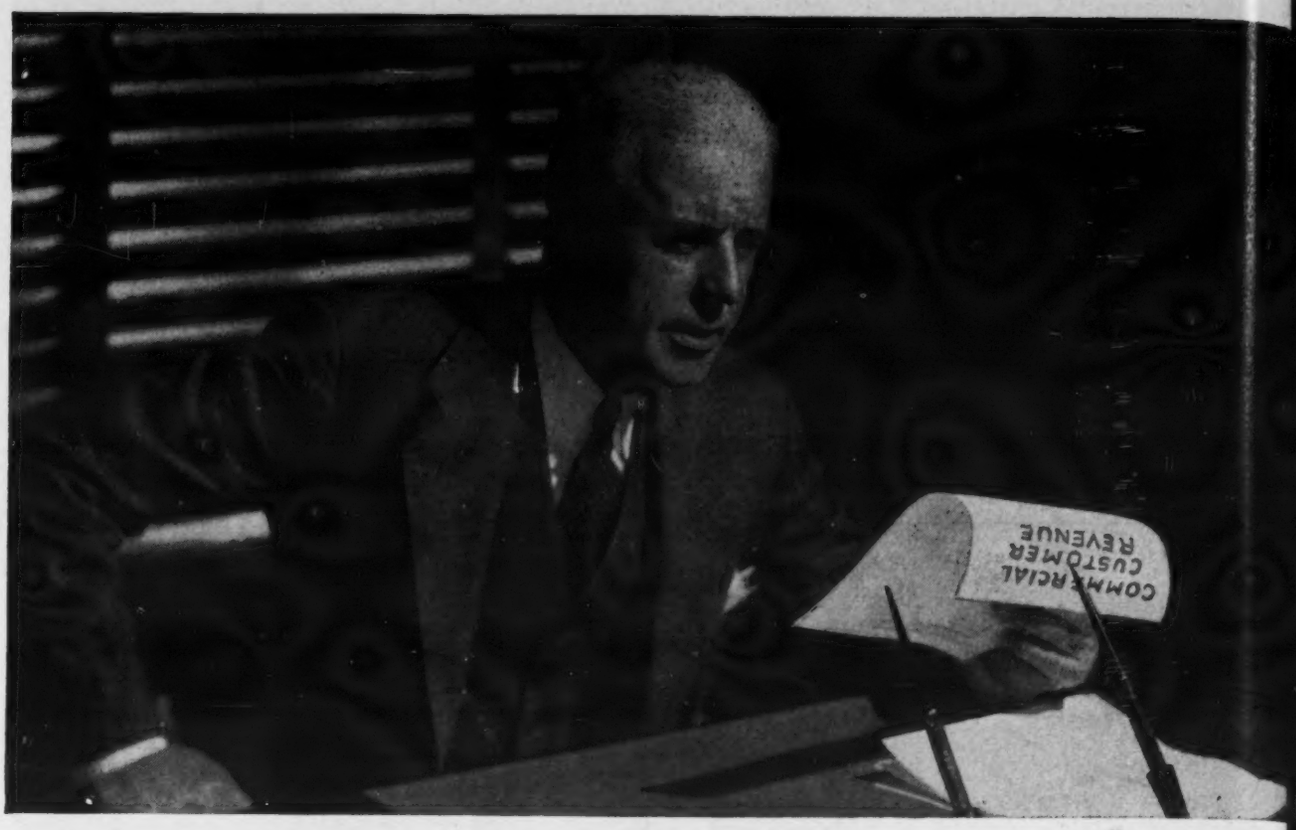


Right Now—Check Over Your Commercial Prospects

LOAD DROP from terminated war contracts need not worry you, if you get busy now. You'll probably be surprised how many cooking or baking prospects you can list who may now be eligible to buy Hotpoint-Edison Electric Cooking Equipment.

You now serve them with electricity for lighting, motors, ventilation and refrigeration. With our help you can influence them to cook electrically and double your revenue.

Equipment Available Now

Tell customers and prospects about this recent ruling: *"If your present equipment is inadequate or beyond repair, consult your distributor or write Hotpoint. New government regulations now permit manufacture of a limited quant of equipment for essential civilian use."*

Team Up With Us

Notice how Hotpoint advertising reaches hotels, re taurants, bakeries, hospitals and institutions—in th own trade publications. It pays you to keep in tou with them because, if not eligible now to buy electri equipment, the day is coming when they will be.

Remind anyone planning a new building of t simplicity, saving and convenience of bringing only one fuel for lighting, power and cooking.

Edison General Electric Appliance Company, Inc.
5618 West Taylor Street, Chicago 44, Illinois

For outstanding achievement ARMY E NAVY in War Production

THE KITCHEN OF TOMORROW WILL BE ALL-ELECTRIC

Hotpoint Edison

COMMERCIAL ELECTRIC COOKING EQUIPMENT

RANGES • BAKE OVENS • ROASTING OVENS
DEEP FAT FRY KETTLES • BROILERS • GRIDDLES

OLDEST AND LARGEST MANUFACTURERS OF ELECTRIC COOKING EQUIPMENT

FOR VICTORY — BUY U. S. WAR BONDS AND STAMPS

FOR YOUR REFERENCE FILES

THESE BULLETINS COVER CIRCUIT BREAKER APPLICATIONS OF EVERY TYPE AND SIZE

WHICH OF THESE BULLETINS DO YOU NEED FOR YOUR FILES?

#3200 Industrial Multi-breakers. 15 to 100 amperes, 230 volts A.C., 2 and 3 Poles.

#3500 Industrial and General Purpose Circuit Breakers. 10 to 600 amperes, 115 to 600 volts A.C., 125 to 250 volts D.C., 1, 2 and 3 Poles.

#4000 Multi-breaker Load Centers. 1 to 16 circuits, 15 to 50 amperes, 115-230 volts A.C., 1 and 2 Poles.

#4500 Multi-breaker Lighting Panelboards. 15 to 50 amperes Branches, 115-230 volts A.C. Mains, 1 and 2 Poles.

#5000 Circuit Breaker Lighting Panelboards. 10 to 50 amperes Branches, 125-250 volts A.C. or D.C. Mains, 1 and 2 Poles.

#5200 Multi-breaker Type MH Distribution Panelboards. 15 to 100 amperes Branches, 230 volts A.C. Mains, 1, 2 and 3 Poles.

#5300 Square D Type ABH Circuit Breaker Distribution Panelboards. 10 to 50 amperes Branches, 230 volts A.C., 125 D.C. Mains, 2 or 3 Poles.

#5500 Square D Form W—Circuit Breaker *Convertible* Distribution Panelboards. 15 to 600 amperes Branches, 600 volts A.C., 250 volts D.C. Mains, 1, 2 or 3 Poles.

#3000 Square D Switchboards. 575 volts A.C. or D.C.

MAIL COUPON NOW FOR YOUR FREE COPIES

SQUARE D COMPANY
6060 Rivard Street, Detroit 11, Michigan EW-1

Please send me Bulletins #_____

NAME_____

COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

PERMANENT MAGNETS MAY DO IT BETTER

70 Permanent Magnets Are Used in a Flying Fortress*

IN the great Boeing B-17, permanent magnets are extremely vital parts of instruments, magnetos, compasses, audio speakers, radio equipment, the automatic pilot, and other highly complicated electrical and electronic devices. Additional permanent magnets in ground equipment help get the plane over its objective and safely home. These applications typify the constantly growing number of uses for which permanent magnets are being employed today.

Because of our 34 years of specialization in the development and manufacture of permanent magnets for peacetime products, our organization has played an important role in supplying units for numerous military machines and weapons. In many instances, uses have been increased and functions improved.

This unusual experience should prove invaluable to you in solving your engineering problems...and our specialists will be pleased to consult with you. Write us, on your letterhead, for the address of our office nearest you—and a copy of our "Permanent Magnet Manual."

*Approximate. Number fluctuates with model and combat requirements.

Back the Attack with War Bonds!

Copyright 1944—The Indiana Steel Products Co.

The
INDIANA STEEL PRODUCTS
Company

★ SPECIALISTS IN PERMANENT MAGNETS SINCE 1910 ★

6 NORTH MICHIGAN AVENUE • CHICAGO 2, ILLINOIS

Is your Copper Carrying FULL WORKING LOAD?

Get the most out of your present system by installing C-D Power Factor Improvement

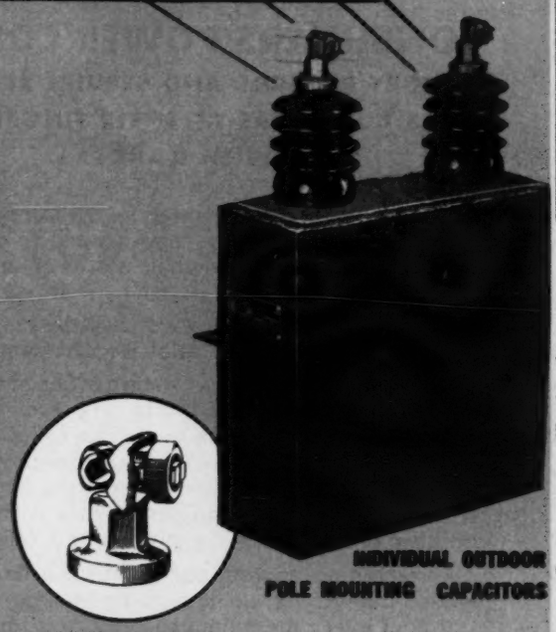
CAPACITORS!

HIS is no day for part-time workers! Capacitors, by raising power-factor, increase system capacity by as much as 40%. Capacitors are oduced with far less material and man hours than new generator and der equipment. C-Ds put your present facilities on a war footing.

k your C-D Power Factor Engineer to show you how Cornell-Dubilier kanol Capacitors can be insta'led quickly . . . how they release gener- capacity, increase substation loadability, raise voltage level of load nd *pay for themselves!*

erica's greatest battle is against time. C-Ds enable you to get MORE in a hurry from existing capacity. Write today for Bulletin No. 143C. nell Dubilier Electric Corporation, South Plainfield, New Jersey. w England Division: New Bedford, Mass.

*There are more Cornell-Dubilier Capacitors in use ay than any other make.**



INDIVIDUAL OUTDOOR POLE MOUNTING CAPACITORS WITH NEW C-D SOLDERLESS CONNECTOR

These capacitors are now equipped with the new sturdy, solderless service connector, exclusive with Cornell-Dubilier. The connector is a standard stock unit, easily replaceable, and usually carried on all construction trucks.

Cornell Dubilier

capacitors for power-factor improvement

*including all applications.

HERE'S "Know-what's-what"!

CONSUMERS POWER COMPANY

HISTORY RECORDS AND SERVICE RECORDS FOR ITS CUSTOMERS AT THEIR FINGERTIPS... WITH KARDEX!

"Know-how" was not enough for the Consumers Power Company in Michigan... they wanted to have available at all times the "what's-what" status of every customer and every service.

They got it...when they installed the Remington Rand KARDEX Visible System of Record Control!

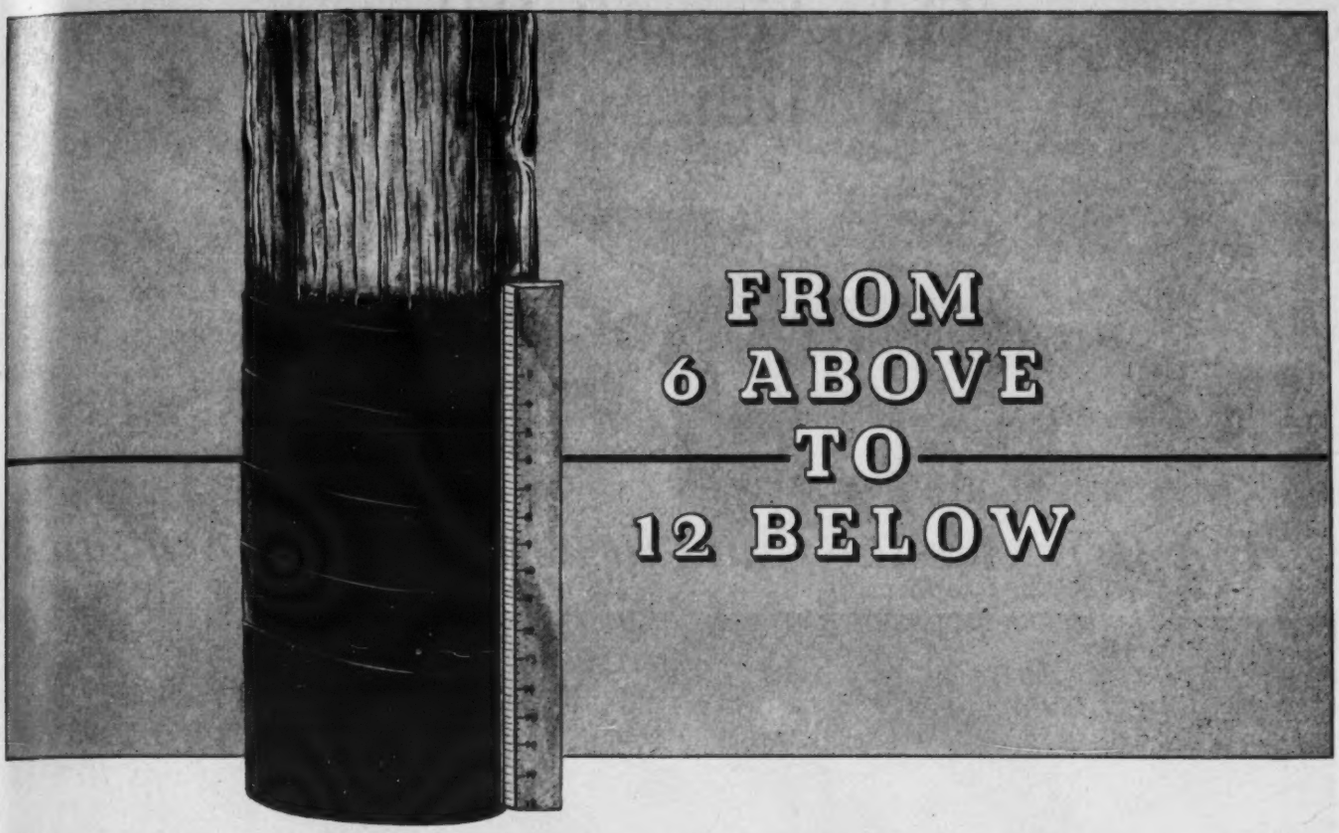
Kardex records in the Customer Service File and the History Record File, help this progressive company to furnish a very high class of service to its customers, at the same time improving clerical efficiency and reducing office costs. These achievements are especially noteworthy in a busy war industry center with an abnormal number of changes in consumers and office personnel.

Outstanding advantages of this Kardex installation, where colored signals flash complete information on the status of every individual account, include—

1. *Customer interview work.* Much heavier than in normal times, this is handled smoothly and efficiently, thanks to centralized records as well as the Unit Desk Plan of bookkeeping.
2. *Employee training* in the record-keeping department, a serious consideration where turnover due war conditions is high. Employee training is greatly simplified by centralized Kardex records with all related data at one point.
3. *Appliance service orders,* which have rapidly increased in number in recent months, are handled fast and efficiently. Complete histories of appliances are available for field men from the service records.
4. *Collection policies* are kept on a current selective basis from individual history records which show the actual collection experience with each customer. By means of this record policies can be keyed to the changes in economic conditions.

You will be interested in the full details of this successful use of the Kardex Visible System by the Consumers Power Company. Phone or write our nearest Branch Office and ask for "Systems Narrator #568".

REMINGTON RAND
BUFFALO 3, NEW YORK

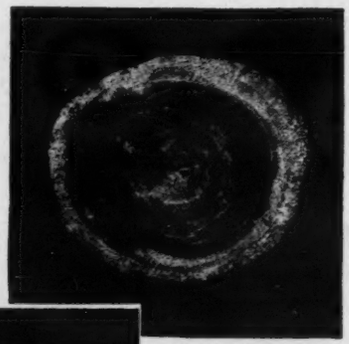


... that's where OSMOPLASTIC does its stuff

Groundline decay... more than any other factor... shortens the life expectancy of poles. It represents an annual loss to utility companies, running into the millions. Thus, in a lineal area of 18 inches ... from 6 above to 12 below... most of the pole damage is done.

Because this decay area is concentrated and easily accessible, OSMOPLASTIC treatment is ideally suited as a low-cost means of prolonging pole life.

The practical experience and maintenance records of many leading utilities that have established periodic groundline inspection and treating programs has resulted in greatly prolonging the service life of over 1,500,000 initially untreated or "B" treated poles through OSMOPLASTIC groundline treatment. Can we show you the factual proof?



The white outer area of this pole cross-section, cut at groundline, shows the deep penetrating action of the toxic chemicals in Osmoplastic.

MAKE INSPECTION TIME, PROTECTION TIME WITH

OSMOPLASTIC

MANUFACTURED BY

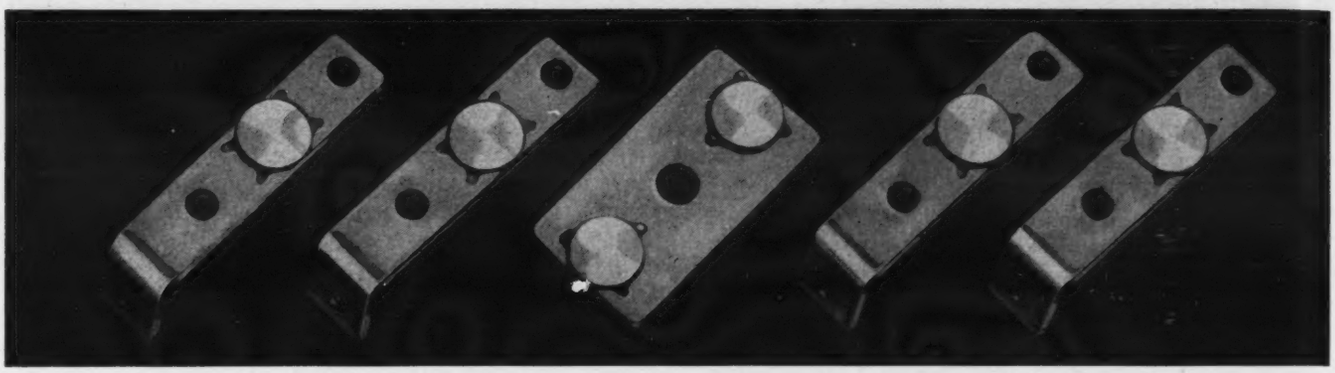
OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

GENERAL OFFICES: BUFFALO 12, N. Y.

BRANCH AND SALES OFFICES: BIRMINGHAM 3, ALA.; DENVER 2, COLO.; NEW YORK 7, N. Y.; KENOVA, W. VA.; HARLAN, KY.; CHICAGO 4, ILL.

This Aircraft Relay Is a Military Secret

...But Here Are the Clues to Its Better Performance



In wartime, we can't mention names or tell the story in full. But the facts are not without significance, even with many details omitted.

One of the first types of aircraft relay to be accepted for military use was equipped with Mallory contacts. As planes improved, and greater performance was demanded, the relay needed further development. The manufacturer needed a better material—and, being pressed for delivery, he needed it fast.

Thanks to Mallory engineering research, it was possible to recommend a new material manufactured by an entirely new metallurgical process —Elkonite* G-12. When this was backed with Mallory 3 Metal, the improved specifications were met. Production was started without a moment's delay *because previous development had paved the way.*

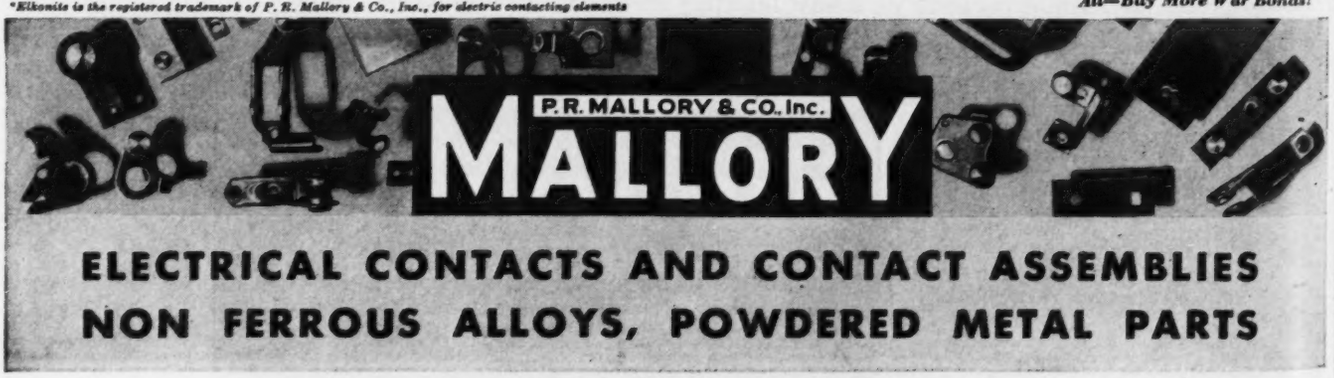
Like the relay manufacturer of this story, many design engineers prefer to consult Mallory *first* —often while plans are still on the drawing board. They've learned that Mallory engineering saves time and money: that it frequently anticipates tomorrow's trends. Why not bring your next problem to these same engineers who, for over a period of twenty years, have earned for Mallory the name of "Contact Headquarters."

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

ARMY E NAVY

For Liberty and Justice for All—Buy More War Bonds!

*Elkonite is the registered trademark of P. R. Mallory & Co., Inc., for electric contacting elements



ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES
NON FERROUS ALLOYS, POWDERED METAL PARTS

LOOK AROUND YOU and LOOK AHEAD

FROM TRANSFORMER TO POINT OF LOAD...

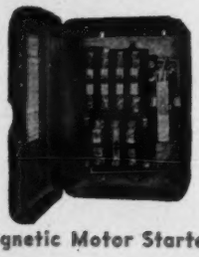
TRUMBULL

distributes... controls... safeguards

POWER IN INDUSTRY

Motor Circuit Switches

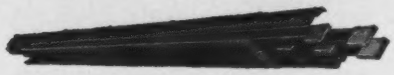
Manual Motor Starters



Magnetic Motor Starters

Combination Magnetic Starters and Disconnects

ENCLOSED BUS BAR DISTRIBUTION SYSTEMS



"AERATED" L. V. D.

Low Voltage Drop System for power distribution in main circuits.

"A switchboard running the length of the plant".

FLEX-A-POWER

for distribution of electric power in secondary circuits, and to points of load through Flex-A-Plugs.

"A panelboard running the length of the plant".

The equipment shown on this page represents some of the major contributions Trumbull engineering has made toward MORE EFFICIENT power distribution and control in industrial plants. This equipment is today helping Industry maintain peak PRODUCTION for war. Tomorrow it will help Industry produce ECONOMICALLY and PROFITABLY for post-war markets.

Control Centers. Prefabricated Motor and Feeder Circuit Control

Panel Boards

Switchboards

"AT" Enclosed Industrial Circuit Breakers

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. – SEATTLE – SAN FRANCISCO – LOS ANGELES

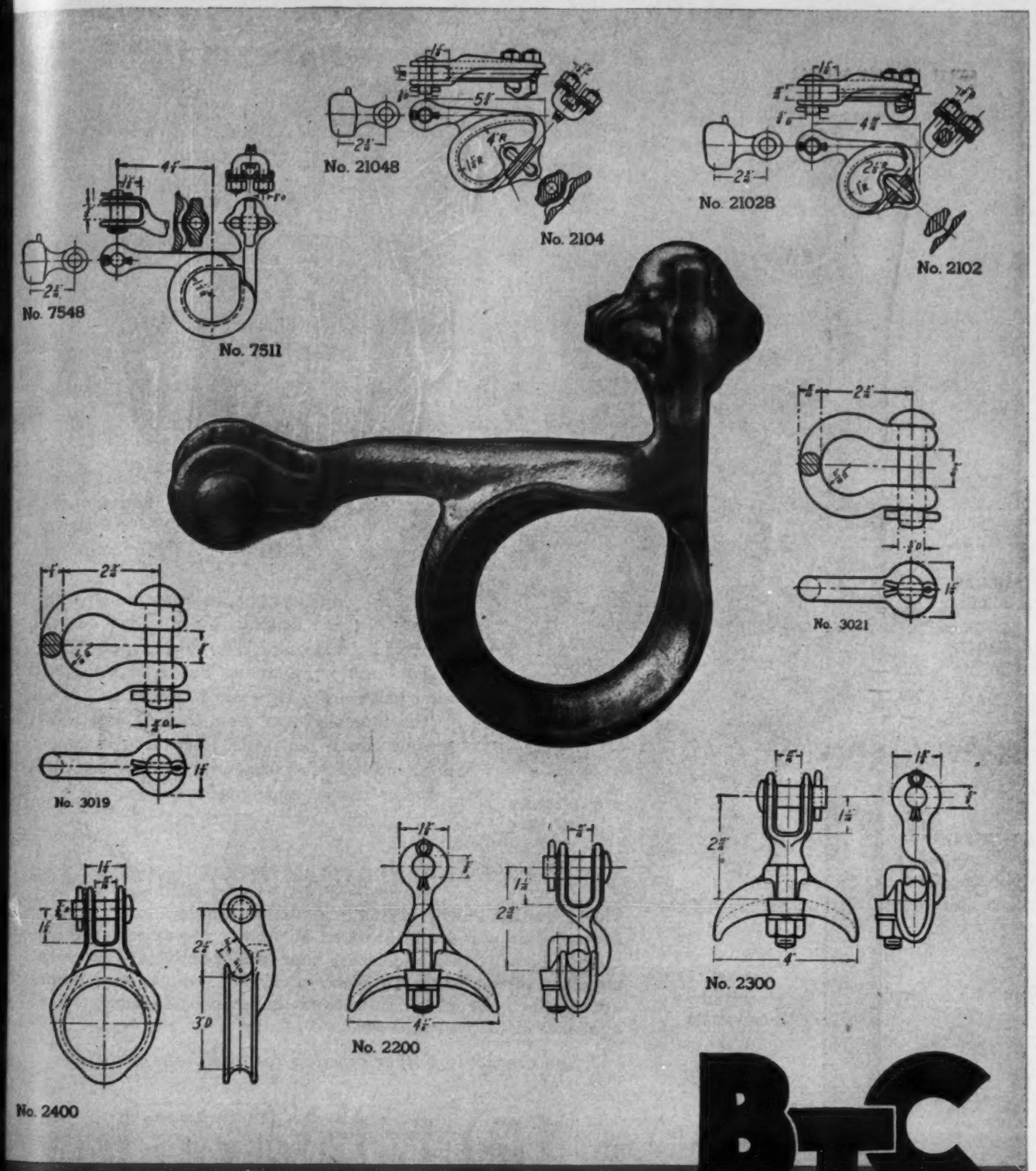
BUILDING A

BTC

The use of forged steel results in light weight with more than adequate strength. Low in price, this hardware is especially adapted to rural electrification.

THE BREWER-TITCHENER CORPORATION

RURAL LINE?



BTC

DROP FORGED HI-LINE HARDWARE

Through Your Insulator Manufacturer Only

CORTLAND, NEW YORK

... from the COMPLETE LINE OF OLIVER LINE MATERIALS

OLIVER
Drive Head Ground Rods

The combination Ground Rod and Clamp shown here offers many time- and money-saving features based upon our extensive experience in the design and manufacture of grounding materials.

The enlarged head provides ample striking surface for fast driving, even under conditions of hard ground. The forged point also assists easy penetration. The top is tinned after galvanizing for extra protection.

The forged clamp (also tinned) and non-ferrous clamp bolt assist in making connections and insure a permanent, trouble-free job.

Made in sizes and lengths shown.

OTHER OLIVER GROUNDING MATERIALS

The Oliver Line has everything needed for grounding, including ground rods wired and unwired and pipes of various lengths, clamps of all types and sizes, caps and points for use with standard pipes, bayonets, wood moulding, staples and other accessories. Regularly furnished hot dip galvanized, also available in Copperweld steel.

See the 1944 Oliver catalog for complete details.

OLIVER IRON AND STEEL Corporation

SOUTH TENTH AND MURIEL STREETS · PITTSBURGH, PENNSYLVANIA

Aerovox oil-filled capacitors for war and for peace—a giant 15,000 volt unit with side terminal and grounded case, to reduce head room; a small "bathtub" unit for use in better-grade radio and electronic assemblies.

TODAY...

Aerovox Capacitors Go to War

TOMORROW...

Aerovox Capacitors Help Build Peacetime Progress

● In countless ways Aerovox capacitors are speeding up the winning of the war. Thousands of skilled workers, carrying out the designs and specifications of engineers long specializing in capacitors, are meeting a large portion of the wartime requirements.

Indeed, Aerovox personnel has expanded threefold since Pearl Harbor. Close to half a million square feet, in two plants, are now devoted exclusively to capacitor production.

Today Aerovox is all-out for the war effort. Winning the war comes first. But tomorrow, when victory shall have been achieved, Aerovox will be ready on a greater scale than ever before to help build for peacetime . . . to serve the capacitance requirements of industry and power companies and other users, along with those of motor-starting and radio and electronics.

Remember the name AEROVOX for capacitors of all types, sizes and quantities. Submit your capacitance problems or needs. Literature on request.

AEROVOX *Capacitors*

INDIVIDUALLY TESTED

AEROVOX CORPORATION, NEW BEDFORD, MASS., U. S. A. • SALES OFFICES IN ALL PRINCIPAL CITIES

Export: 100 VARICK ST., N. Y. C. • Cable: 'ARLAB' • In Canada: AEROVOX CANADA LTD., HAMILTON, ONT.

More Power to

-these J-M Electrical Materials are helping to transmit peak power loads to speed war output

ELECTRIC POWER is the very heartbeat of our war production. Hundreds of machines and materials must work together to keep that power pulsing through the nation's underground and overhead distribution networks. Not even the smallest part can be allowed to fail.

Throughout the electrical industry, Johns-Manville Electrical Materials are helping avoid waste, save fuel, cut costs. Backed by the knowledge accumulated through 86 years of experience, these products are playing a war role today and, in most cases, are also available for construction and maintenance requirements.

The complete line of Johns-Manville Electrical Materials is described in Catalog GI-6A. Send for your copy today. Write to Johns-Manville, 22 East 40th Street, New York 16, New York.

OTHER JOHNS-MANVILLE PRODUCTS FOR THE ELECTRICAL INDUSTRY

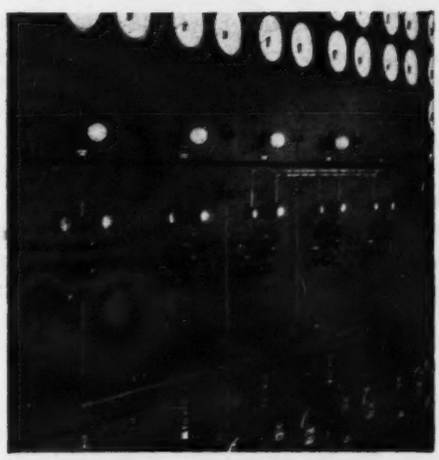
ELECTRICAL MATERIALS NOT ILLUSTRATED:

Chemstone
Electrobestos
Asbestos Tapes
Friction Tapes
Splicing Compounds
Asbestos Transite

ALSO

High Temperature Insulation
Refractories
Transite Partitions
Acoustical Materials
Packings
Built-Up Roofing
Industrial Flooring
Transite Pressure Pipe

JOHNS-MANVILLE ELECTRICAL MATERIALS

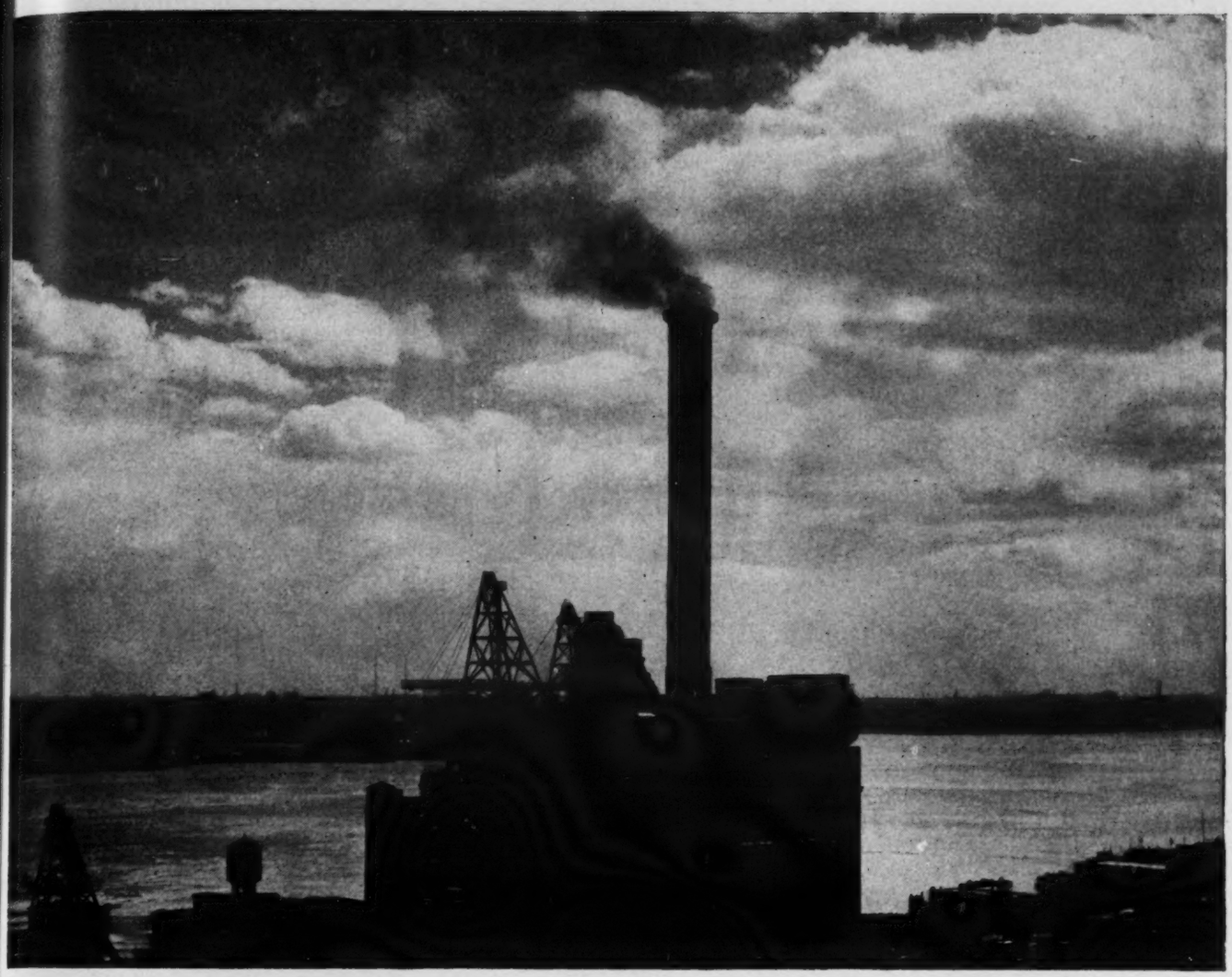


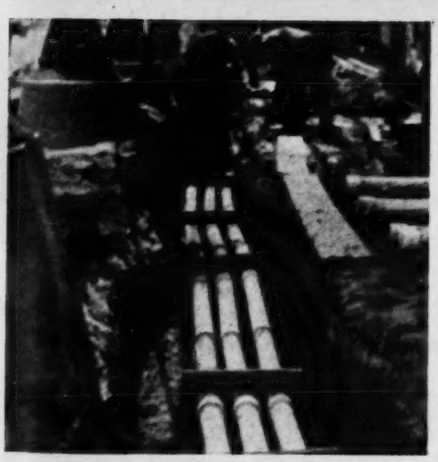
ASBESTOS EBONY, now again available, is a permanent, light-weight mineral product. It won't rust, rot, shrink, crack or buckle. Impervious to water, gas, oil and ordinary chemicals. Has high dielectric strength and insulation resistance.

TRANSITE CABLE TRAYS are made of an incombustible, strong, corrosion-resistant material. Designed to support control cables and low-capacity power cables, Transite Cable Trays save space, cost less to install, need no maintenance.

CABLE FIREPROOFING. Niagrite-Asbestoment, consisting of Niagrite, a commercially pure asbestos tape with or without reinforcement, and an efficient refractory, Asbestoment, provides fireproof protection for cables.

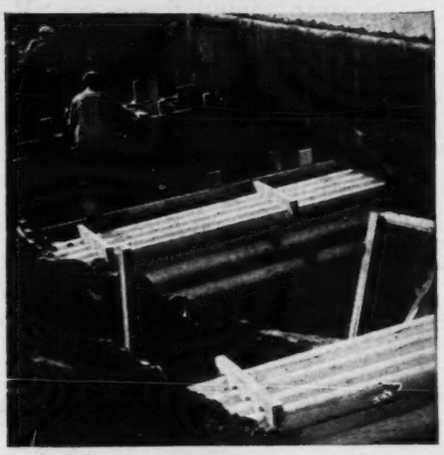
War Industry!





TRANSITE CONDUIT. Made of asbestos fiber and cement, Transite Conduit is approved for use underground without concrete envelope. Both Transite Conduit and Korduct help provide lower installation cost and reduced maintenance expense.

SEALING COMPOUNDS. J-M makes several sealing compounds—Duxseal, Pakseal, Tranolseal and Nodrseal—each one with certain characteristics. All are easily workable at 35° F., with no slump at 300° F. They won't harden materially when exposed to air.



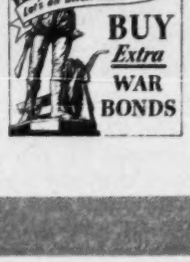
TRANSITE KORDUCT. Korduct is identical with the Conduit except for its lesser wall thickness. Like Transite Conduit, Korduct is fireproof and highly resistant to internal or external corrosion, electrolysis and action of soil chemicals.

"BIG GUNS"

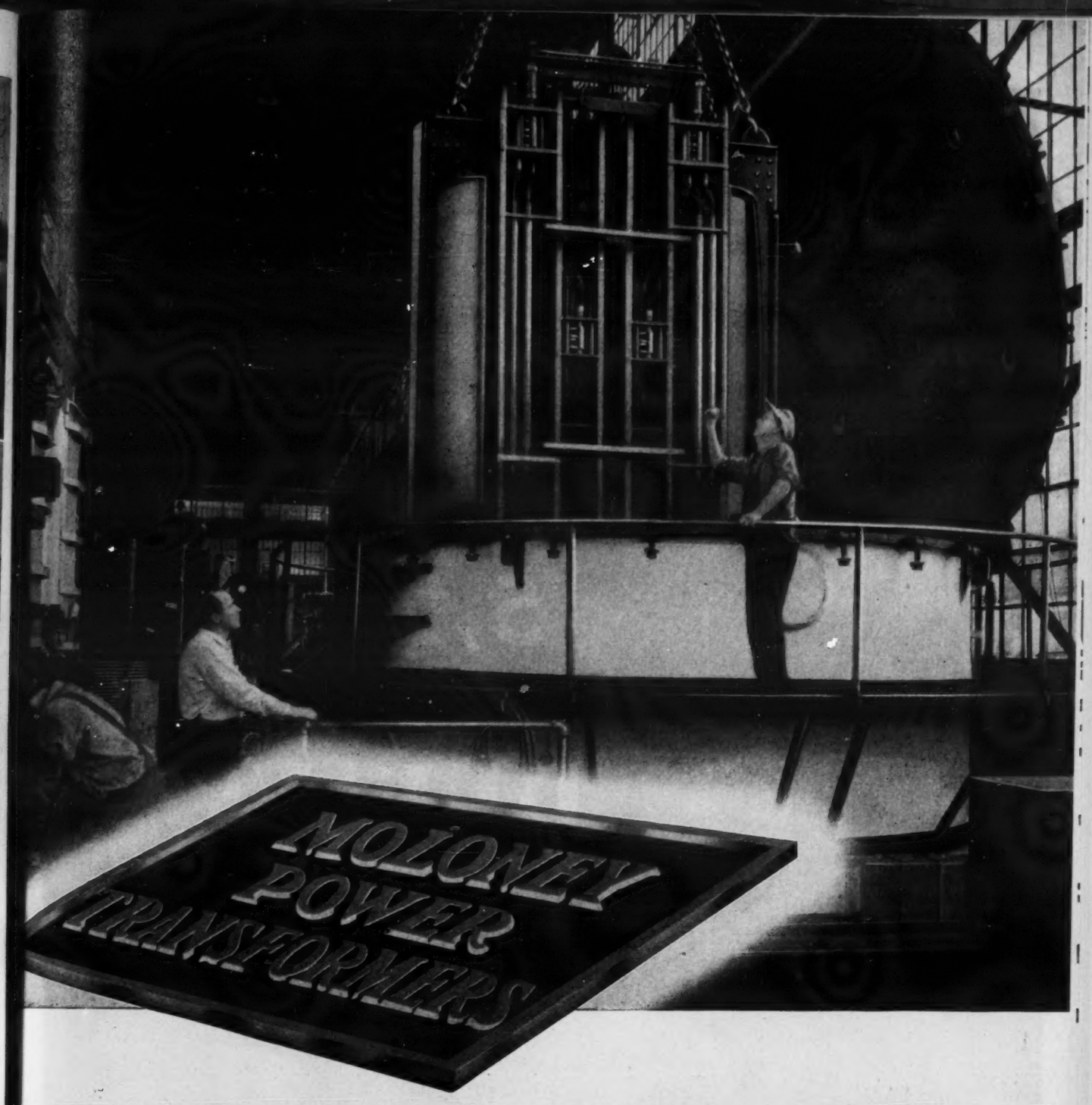
OF THE NATURAL GAS INDUSTRY

LIKE our nation's heavy artillery, these "big guns" of the Natural Gas industry are helping to win decisive battles for our armed forces on all fighting fronts. Welded and coupled together, they perform functions that are indispensable to the war effort — transmitting and distributing Natural Gas whenever and wherever it is needed, through pipe lines that span the continent. ¶ This industry today is performing a two-fold service to the nation. While continuing essential fuel supplies to our people, it produces and distributes gas for myriad wartime uses, including the production of sinews of war — ranging from explosives perfected by recent chemical advances to healing agents in the name of mercy.

Columbia System is now supplying more Natural Gas and Electricity for industrial use than ever before in its history.



COLUMBIA GAS & ELECTRIC CORPORATION



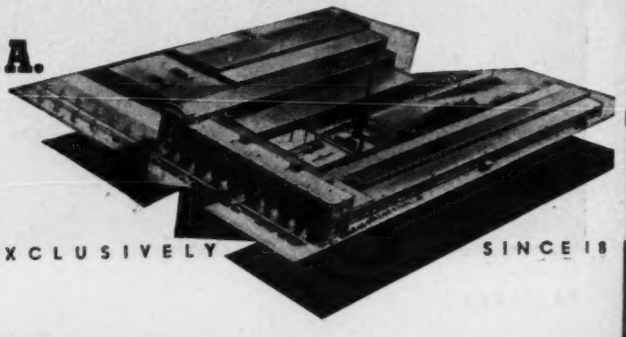
tured above is a Moloney 21,000 Kva 161,000 t core-and-coil assembly being lowered into one of large vacuum tanks for drying treatment.

Moloney has all the necessary experience and facil- s for designing, building and testing large power nsformers. The Moloney background is supplied by er 45 years of experience in the exclusive manu- cture of transformers.

Capable design engineers incorporate moderr practices in these transformers. Skilled labor and ad equate processing facilities accurately translate the design into the finished product.

Take advantage of Moloney Power Transforme experience and facilities. For prompt quotation, ad dress your next inquiry to Moloney Electric Company St. Louis, U. S. A.

OLONEY ELECTRIC CO. • ST. LOUIS, U.S.A.



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STRUTHERS-DUNN
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5,288 TYPES OF RELAYS

Each available in
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The value of proper facilities, experience, production control, and step by step inspection is brought out in the manufacture of such porcelain products as featured on this page. For example, in ILLINOIS Pothead Porcelain the surfaces of every piece, both at top and bottom, are parallel. You get perfect alignment of porcelain hole and mounting base in ILLINOIS Porcelain Bushings. ILLINOIS is equipped to make all sizes and shapes of Gooseneck Porcelain Bushings to the transformer builders' specifications.

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NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

NEWPORT NEWS, VIRGINIA

From green mold

—*a new weapon against death*

From a mold like that formed on bread and cheese, science has evolved a new bacteriostatic agent of extraordinary potency . . . ***penicillin,*** regarded as one of the most striking medical developments since the introduction of the sulfa drugs.

In the production of penicillin, *air conditioning and refrigeration* play essential roles at three important stages . . . maintaining correct temperature and humidity for production of the mold; providing low temperatures which prevent destruction of the drug while in solution; and speeding the dehydration of the solution.

Since penicillin production is relatively new, no standard process has yet been adopted. Hence air conditioning and refrigeration installations are usually individually designed. Here is *one* of the reasons why penicillin manufacturers turn to G-E . . . pioneers in adapting air conditioning and refrigeration to an almost endless list of industrial uses.

If industrial air conditioning or refrigeration can help you in war production today, or in postwar production tomorrow, turn to G-E with confidence . . . for engineering advice and for equipment of proven quality.

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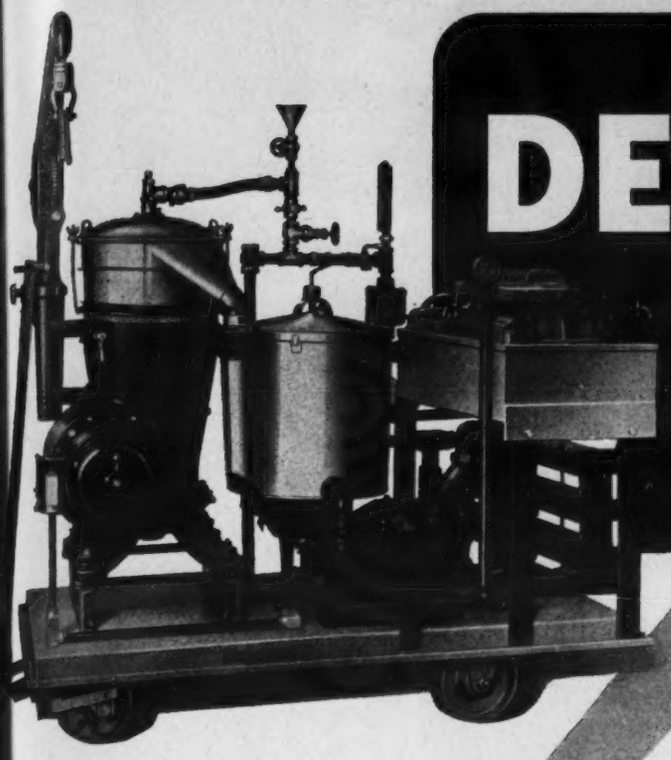

WITH DE LAVAL INSULATING OIL PURIFIERS

SPEED and economy of operation combine with dependability of results to make the De Laval Insulating Oil Purifier the choice of leading power systems in meeting their oil maintenance problems.

The De Laval Purifier restores the required high dielectric value of oil in a single pass, eliminating re-runs; continuously discharges water, permitting long, continuous operation at uniformly high efficiency with a minimum of attention. As a result, the yearly cost of dehydrating oil in transformers and circuit breakers can be much reduced.

Speedier, less costly oil purification, which is at the same time more positive, leads naturally to improving the average dielectric value of oil in all units, thus contributing directly to dependable sub-station performance.

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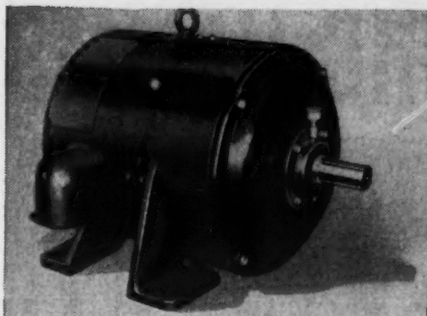
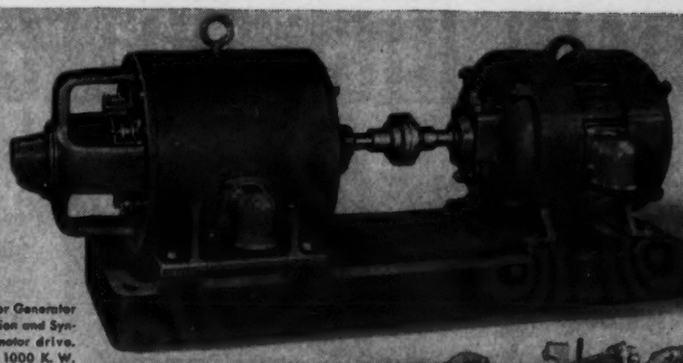
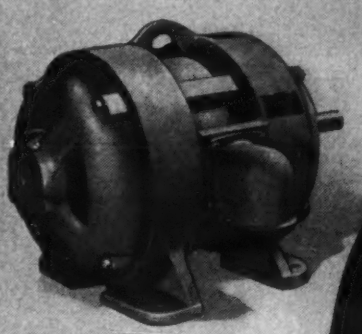
De Laval INSULATING OIL PURIFIERS



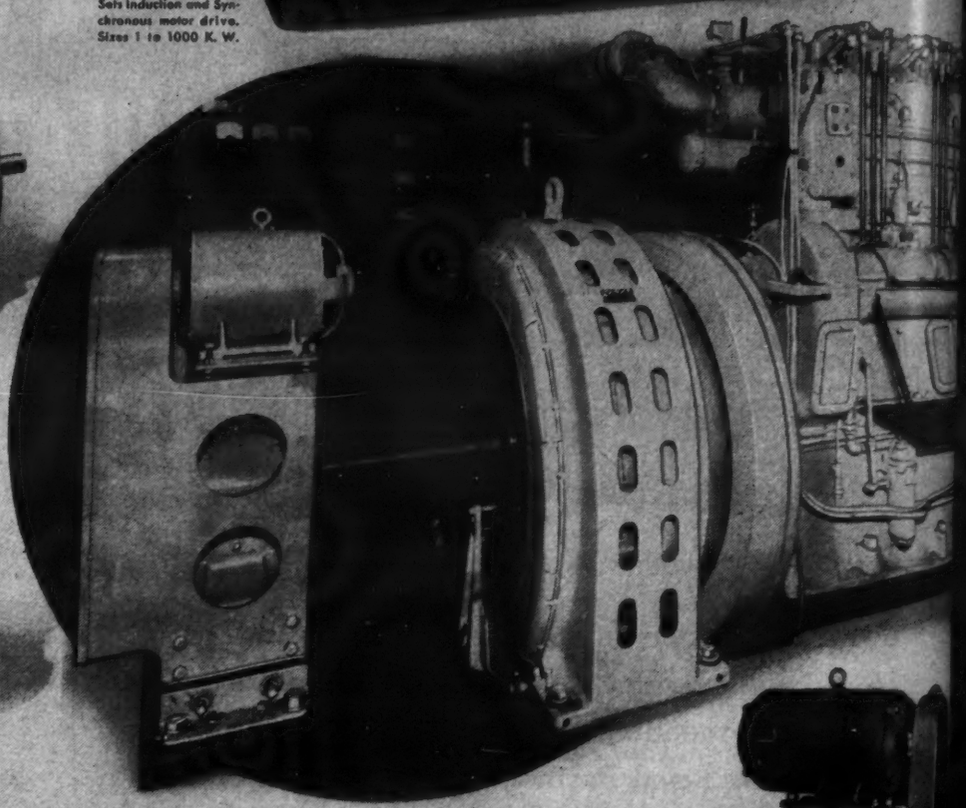
Burke Bracket Type D.C. Motors and Generators. Sizes 1 to 1000 K.W.



Burke Motor Generator Sets induction and Synchronous motor drive. Sizes 1 to 1000 K. W.



Burke Induction Motors, ball or sleeve bearing. Sizes 1 to 1500 H. P.



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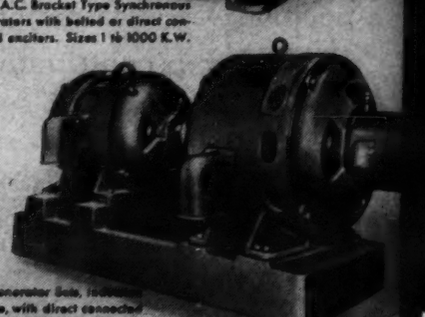
Burke Vertical Induction Motors for pump drive. Sizes 1 to 1500 H. P.

Designed for the Job

BURKE offers to industry a highly specialized experience in applying its wide range of standardized motors and generators to meet specific requirements from one horsepower up. Wherever the maximum in capacity and overload are demanded, it will pay you to get Burke's recommendation, for Burke stresses quality and workmanship in every detail. You can depend on a Burke for more than its rating.

Burke A.C. Bracket Type Synchronous Generators with belted or direct connected exciters. Sizes 1 to 1000 K.W.



Burke High Cycle Motor Generator Sets, Induction or Synchronous motor drive, with direct connected exciters. Sizes 5 K.W. to 500 K.W.

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W

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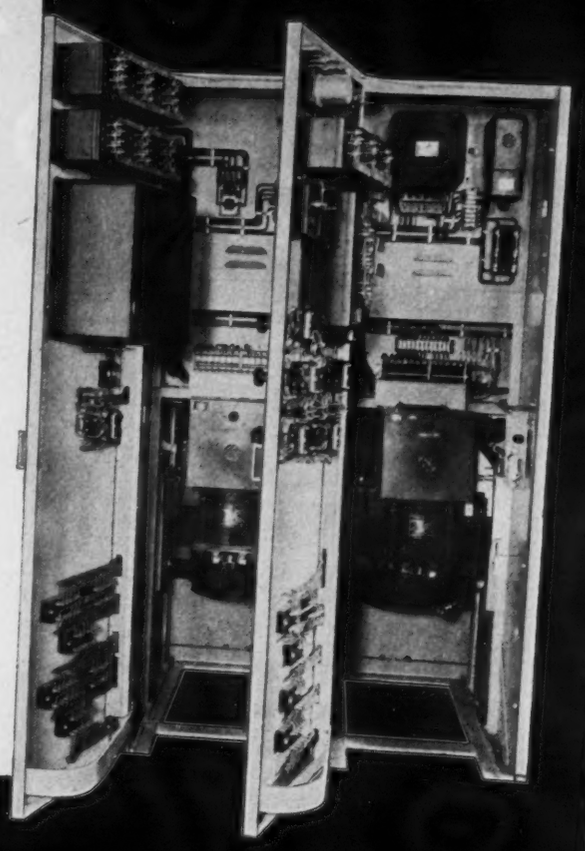
In Post-War Plans—

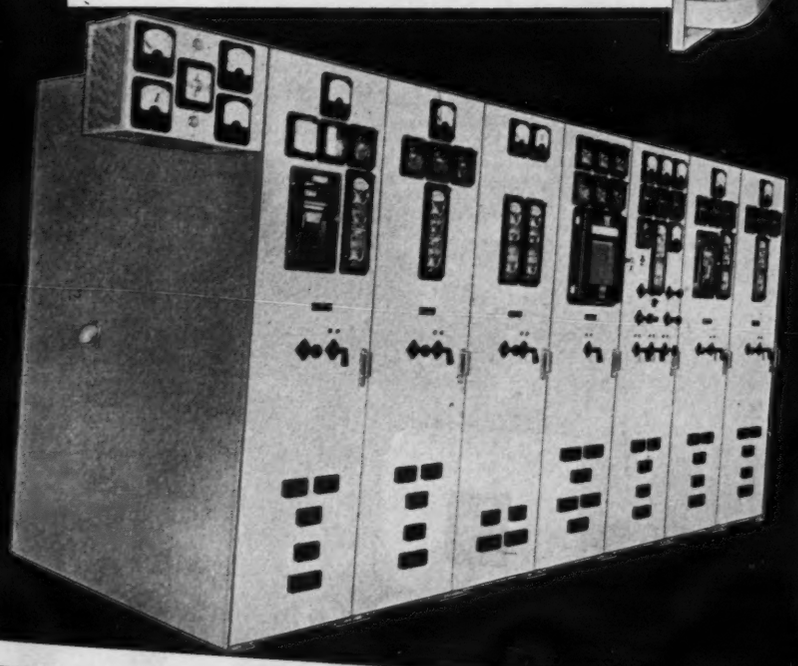
Be sure to consider modernizing hazardous, unsightly switchboard installations with up-to-date Metal-Clad Switchgear.

Metal-Clad is the best construction the industry has produced, not only from standpoint of appearance but also from aspects of safety, economy, simplicity and flexibility.

It's safe, all equipment is enclosed and electrical connections insulated — preventing accidental contact. Interlocks guard against accidents due to split-second mental lapses during excitement in emergencies.

When you buy DELTA-STAR Metal-Clad Switchgear you have the opportunity for specifying equipment that best meets your requirements and choice.





DELTA-STAR Metal-Clad Switchgear is of the self-contained vertical lifting and lowering type with stationary housing and removable element. Furnished in two types: "Acorn" Type "RA" with breaker ratings to 50,000 kva, 5000 volts, 2000 amps., and standard duty Type "RI" with breaker ratings to 500,000 kva, 15000 volts, 2000 amps.

DELTA-STAR ELECTRIC COMPANY

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Indianapolis, Ind.
Kansas City, Mo.
Knoxville, Tenn.
Los Angeles, Cal.
Minneapolis, Minn.
New Orleans, La.
Norfolk, Va.
Omaha, Neb.
Philadelphia, Pa.
Pittsburgh, Pa.
Richmond, Va.
St. Louis, Mo.
San Francisco, Cal.
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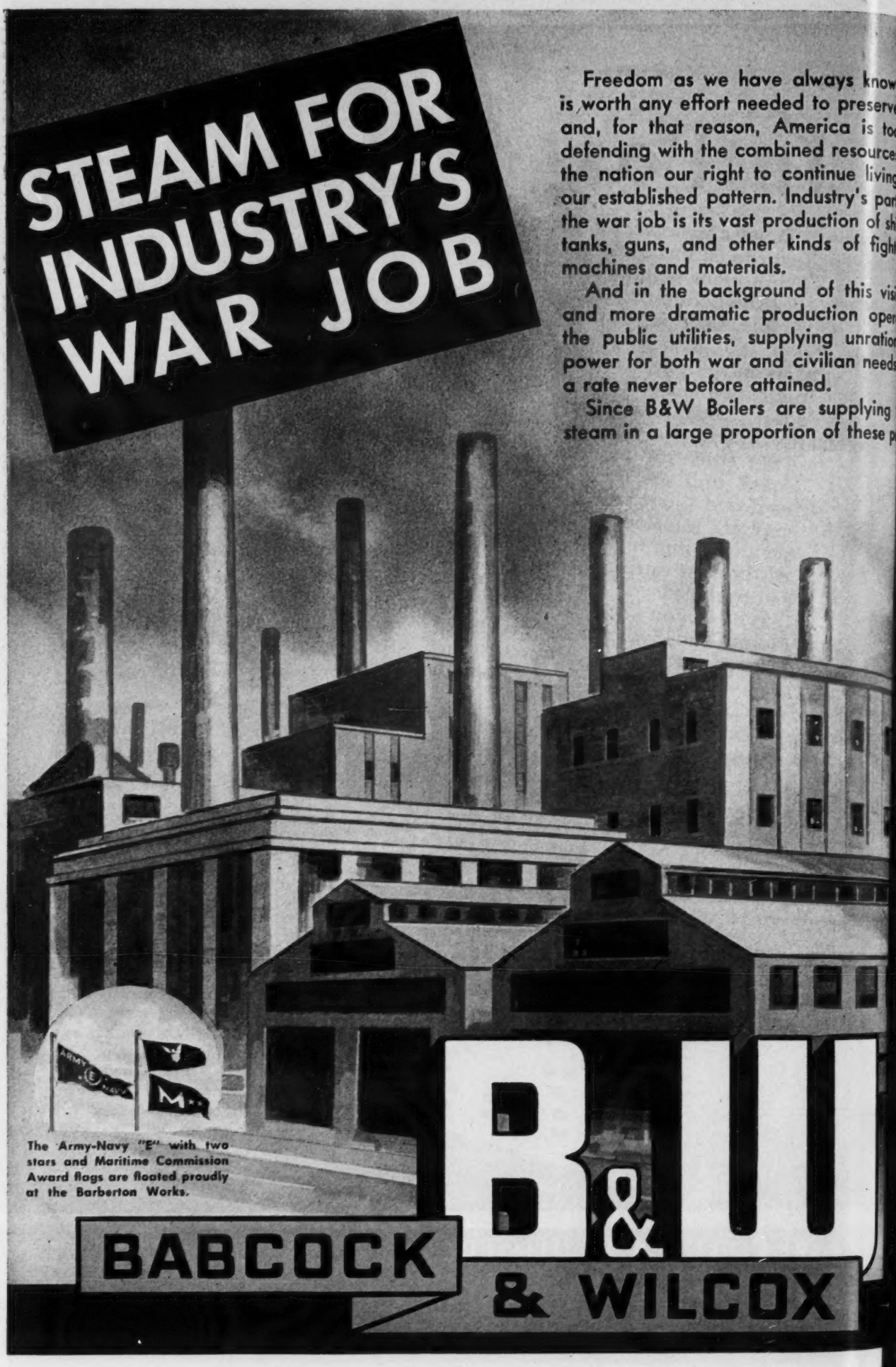
Canadian Line Materials Limited ..... Toronto 13, Canada

STEAM FOR INDUSTRY'S WAR JOB

Freedom as we have always known
is worth any effort needed to preserve
and, for that reason, America is tod
defending with the combined resources
the nation our right to continue living
our established pattern. Industry's part
the war job is its vast production of shi
tanks, guns, and other kinds of fighti
machines and materials.

And in the background of this visi
and more dramatic production oper
the public utilities, supplying unration
power for both war and civilian needs
a rate never before attained.

Since B&W Boilers are supplying
steam in a large proportion of these p



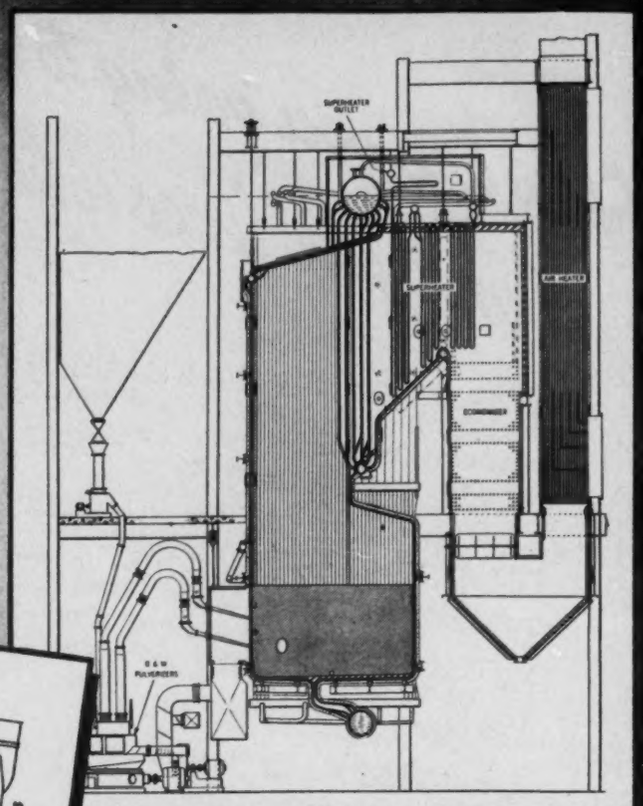
The Army-Navy "E" with two stars and Maritime Commission Award flags are floated proudly at the Barberton Works.

BABCOCK & WILCOX

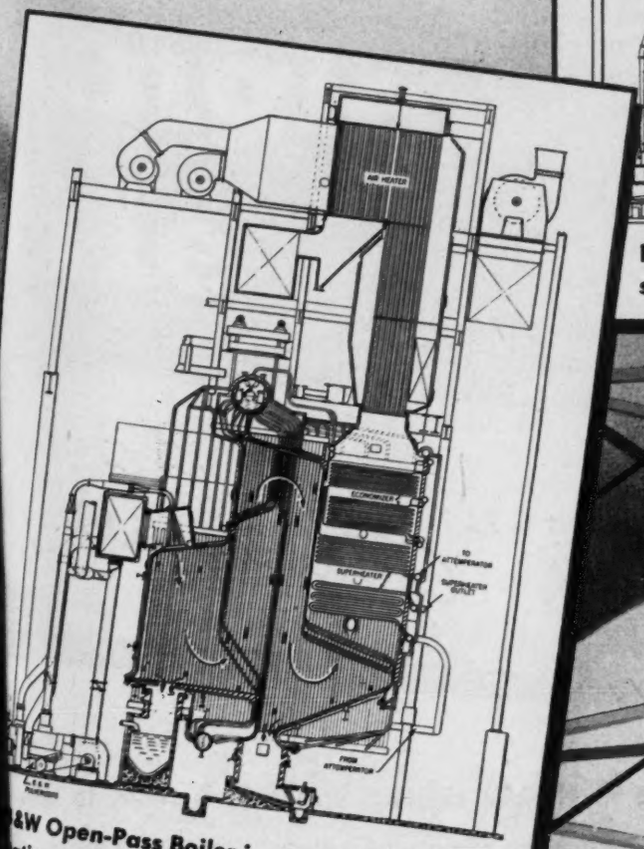
B&W

lic utility and industrial power plants, and for propelling naval and cargo ships, B&W is playing a substantial part in this great war effort. B&W engineering and production skill have built into its boilers the stamina to endure today's gruelling drive.

With today's accelerated experience yielding more complete answers to such problems as behavior of metals at high temperatures, action of fuels in slag-tap and dry-ash furnaces, circulation in high-capacity high-pressure boilers, separation of steam from water in boiler steam drums, and other related problems, the boilers of tomorrow should be even better able to serve industry.



B&W Radiant Boiler in an eastern central station—Capacity 400,000 lb. steam per hr.



&W Open-Pass Boiler in an eastern central ation—Capacity 350,000 lb. steam per hr.

HE BABCOCK & WILCOX COMPANY
5 LIBERTY STREET NEW YORK 6, N. Y. G-254

How are you going to keep load on your lines when peace comes?

No question but that lighting is your No. 1 opportunity right away ... because response is fast ... conversion problems fewer ... and desire, especially in stores, is great.

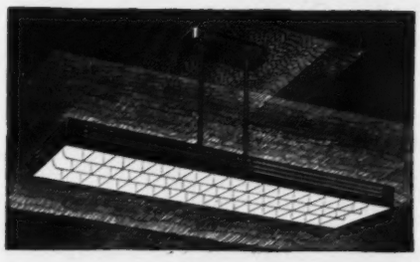
But this opportunity has two paths. One of them leads to just lighting, with fixture-for-fixture replacement. You can follow it with almost no effort ... but that means no increase in sales power for your customers ... and probably a reduction in load.

The other path leads to lighting keyed to modern needs ... lighting fitted to the job, with effective improvement in sales power and the possibility of more load.

There's no doubt about the path that the leaders will choose. You'll want to start the revival of your lighting department now ... with the budget, the manpower and the training to do the job.

Sincerely,

A. F. Wakefield



When it comes to Planned Lighting, Wakefield is ready to help

Wakefield lighting equipment is always engineered for top-n performance. That's why Wakefield's policy *now and postwar* is to w with you for engineered lighting installations. Typical of the Wake fixtures that can help you provide good lighting for essential jobs is the ADMIRAL. Made largely of wood, it conserves materials and vides efficient, diffused high-intensity light. Write for details.

THE F. W. **Wakefield** BRASS COMPA

RED ● SPOT LIGHTING FOR WAR PRODUCTION . . . FOR PEACETIME FUTU

VERMILION, OHIO

Like Giants in single file
THEY look like giants, these Blaw-Knox Transmission Towers, striding single file across the landscape.
They are giants; for in their grip of steel is power for a thousand mills. Utility engineers around the world have long appreciated — in Blaw-Knox towers — the strength and durability and scientific design that make for efficient and economical operation.
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To Keep Away From Rust ★ ★ ★ *To Keep Wiring Safe*

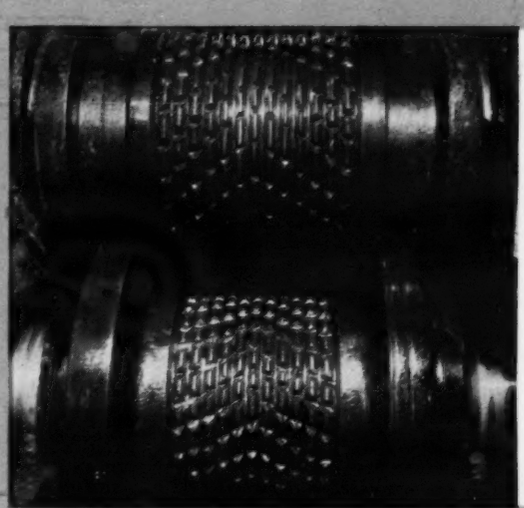
Engineers Specify

SHERARDUCT

RIGID STEEL CONDUIT

Electricians like it for Another Reason:

"It's Easily Worked... It Bends"



SHERARDUCT IS SPELLERIZED

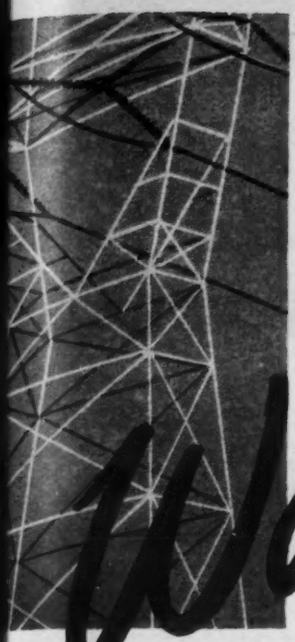
The Spellerizing process produces a fine even grained, highly refined and homogeneous textured steel. It may be compared to the kneading of dough. Dough is kneaded to produce a smooth, uniform texture, to facilitate the escape of confined gases which would form air holes and other irregularities in the substance.

Much the same process and results are obtained in Spellerizing a steel bloom. The process consists of rolling the heated bloom through rolls having regularly shaped projections on their working surfaces, then subjecting the bloom to the action of smooth faced rolls. This procedure is repeated a number of times till the desired results are obtained.

Spellerizing produces a pipe that works more smoothly, bends easier and threads cleaner. The softer, more even grained texture, free from pits, allows the pipe to bend more readily without cracking or splitting. Threading dies encounter no rough spots, no soft spots, producing cleaner, sharper threads which couple together easier and form a perfect electrical bond.

National Electric Products Corp.

Pittsburgh, Pa.



War Record

THIS is the fortieth January in which ELECTRICAL WORLD has presented a statistical review of the past year's operations of the electric light and power industry. Back in 1905, when these annual data were first compiled, the information was fragmentary, whereas today a whole volume of data are presented as a record of the past year.

And what a record the industry has to show for the second year of the war! Some of the high points of 1943 undoubtedly will be surpassed in 1944, but not for many years will the electric utility industry be called upon to exceed the previous year's production to the same extent. The excess of 1943 over 1942 in percent was but 17, which to the casual observer might not be amazing, but this was 32 billion kilowatt-hours, which really is something when one considers that it took the industry from 1882 to 1936 to produce 100 billion kilowatt-hours in one year. Or go back two years and we find that the excess requirements of war were more than 50 billion kilowatt-hours. Suppose some one had said to the industry at the time of Pearl Harbor that in addition to what it was then producing there was going to be superimposed on it within two years the entire task of 1923, would we have believed it could be done without faltering anywhere along the line?

Not only was it done, but with the addition in the two war years of less than a third of the generating capacity used to carry the 1923 load, and with fewer employees than were on the pay rolls at the time of Pearl Harbor.

As large as some of the figures for the year's accomplishments seem, however, they are by no means the peak performances that, as some utility economists believe, will stand unsurpassed for years. In fact, there is every reason to believe that when we record the results of the power industry in our fiftieth statistical number, ten years from now, we will show the decade after the war to be the greatest for expansion in the entire history of the industry.

40th ANNUAL STATISTICAL NUMBER

Summary Statement of OUTSTANDING FACTS

	1933	1937	1938	1939	1940	1941	1942	1943*
FIXED CAPITAL ($1,000,000)	12,800	12,940	.....	.....	.....	14,143	.....	.....
Securities issued [1] ($1,000)	56,248	646,312	964,005	996,347	989,459	740,832	356,254	371,064
New capital	6,813	81,984	123,056	16,219	92,376	97,065	92,666	9,921
Refunding	46,912	563,699	840,949	980,128	897,083	643,767	263,588	361,141
REVENUE [2] ($1,000)								
From ult. consumers	1,754,566	2,160,798	2,156,580	2,289,583	2,440,218	2,665,057	2,885,843	3,096,000
Rural	46,502	37,726	38,928	45,484	49,473	64,396	75,027	80,000
Residential	623,797	759,824	802,532	843,158	895,951	938,229	990,185	1,047,000
Small light and power	471,781	616,438	632,091	660,683	689,253	725,117	767,279	780,000
Large power and light	468,390	583,197	518,694	572,659	631,428	758,083	828,318	953,000
Other consumers	144,096	163,611	164,334	167,597	173,752	179,233	195,034	236,000
EXPENDITURES ($1,000)								
Capital	129,300	455,480	482,000	430,000	596,580	654,148	522,200	306,286
Operating, total	795,811	1,027,588	.....	.....	.....	.....	.....	.....
Salaries and wages	292,000	470,353	460,000	469,500	488,000	537,000	.....	.....
PRIVATE COMPANIES ($1,000)								
Operating revenue	1,664,000	2,031,000	2,018,000	2,148,000	2,277,000	2,475,000	2,611,000	2,816,000
Operating expenses	579,000	781,000	762,000	798,000	863,000	950,000	1,011,000	1,134,000
Taxes	215,000	308,000	323,000	352,000	404,000	521,000	630,000	710,000
OUTPUT [3] (1,000,000 kw.-hr.)								
Generated	78,933	121,837	116,681	130,336	144,985	168,170	189,181	221,000
From steam	46,976	76,330	70,727	85,007	95,675	115,276	123,356	144,900
From water power	31,357	44,489	44,834	44,021	47,753	51,262	64,179	74,400
From internal combustion	600	1,018	1,120	1,307	1,557	1,632	1,646	1,700
CAPACITY [3] (1,000 kw.)								
Generator ratings	33,734	37,134	39,042	40,318	41,639	44,092	46,407	49,442
Steam	24,166	25,873	27,203	28,047	29,019	30,823	32,332	34,262
Hydro	8,975	10,576	11,066	11,415	11,675	12,264	13,025	14,112
Internal combustion	593	685	773	856	945	1,005	1,049	1,068
FUEL CONSUMPTION [3]								
Coal (1,000 short tons)	28,039	44,766	40,212	46,223	53,398	64,760	68,420	76,950
Oil (1,000 bbl.)	9,466	14,143	13,077	17,423	16,722	20,250	15,280	15,280
Gas (billion cu. ft.)	101	171	171	191	183	205	239	288
ENERGY SALES [3] (1,000,000 kw.-hr.)								
Ult. consumers	65,916	99,359	93,731	105,768	118,643	140,060	159,408	186,000
Rural	1,633	1,670	1,577	1,881	1,991	2,352	2,890	2,875
Residential	11,359	17,691	19,371	21,084	23,318	25,124	26,937	28,775
Small light and power	11,589	18,075	19,137	20,722	22,373	24,628	27,234	29,100
Large power and light	33,857	51,360	43,140	51,108	59,557	76,060	88,378	106,050
Other	7,478	10,562	10,505	10,972	11,405	11,896	13,968	19,200
CUSTOMERS [3] (1,000)								
Total number	24,027	27,262	28,064	29,105	30,191	31,607	32,210	32,395
Rural	713	519	526	634	686	987	1,096	1,182
Residential	19,301	22,372	23,112	23,965	24,952	26,025	26,620	26,818
Small light and power	3,621	4,072	4,127	4,215	4,260	4,300	4,219	4,133
Large power and light	335	197	192	184	178	173	150	152
Other	.....	102	107	106	115	122	125	110
People in homes served (1,000)	82,500	93,853	96,915	100,855	97,424	102,695	104,882	105,762
Per cent of total population	66.7	73.1	74.9	77.3	74.0	78.0	77.4	77.4
EMPLOYEES, total	.....	279,000	270,000	269,000	265,000	270,000	.....	.....

* Estimated, generally on ten months' operations. [1] Includes warrants and rights. [2] Revised figures beginning with 1937 conform to Uniform System of Accounts. [3] Includes other electric, in addition to light and power.

War Load Taken in Stride

HIGHLIGHTS

OUTPUT: 221 Billion Kw.-Hr.

Increase in 1943 greater than in 1942, 17 and 12 percent. Hydro has biggest year, contributing 32 percent of increase over 1942. Output from government owned plants rises to 18 percent of total.

CAPACITY: 49.4 Million Kw.

Up 6.6 percent, 3.0 million over 1942. Reserves decreased. Fuel capacity proportionally slightly smaller than in 1942. Increase in proportion of government-owned capacity 2 percent, now 19.4.

NEW CAPACITY: 2.9 Million Kw.

Scheduled future additions during war period total to 1.75 million kw. of which 52 percent is fuel power. Three times as much capacity installed in 1943 as was contemplated when control of additions began.

CUSTOMERS: 32.4 Million

Increase of 0.57 percent shows a distinct slowing-up of growth. Drop in "Commercial and Industrial" classification indicates that mortality among small business concerns continued through 1943.

ENERGY SALES: 186 Billion Kw.-Hr.

Rate of increase of total sales greater than in 1942. Increase in total sale of energy to residential customers almost identical with previous year. Largest increase in average domestic sale since 1937.

REVENUE: 3.1 Billion Dollars

Rises 7.3 percent over 1941. Average residential revenue per kw.-hr. continues down to 3.64 cents. Revenue from government-owned industrial plants puts miscellaneous classification out of line.

OPERATING EXPENSES: 1.1 Billion Dollars

Operating ratio before taxes rises 1.6 percent over 1942. Taxes now up to over 25 percent. Operating revenue up 7.9 percent, operating expenditures up 12.1 percent.

BUDGET: 370 Million Dollars

Drop of 23 percent from 1943 actual to 1944 proposed expenditures for capital additions. Large decrease in expenditures for construction of production facilities. Transmission and distribution increase.

MANUFACTURING

Production for war raises volume 25 percent over 1942. Increase of 50 percent in the manufacture of industrial apparatus. New orders 5 percent below those of 1942, indicating that peak has passed.

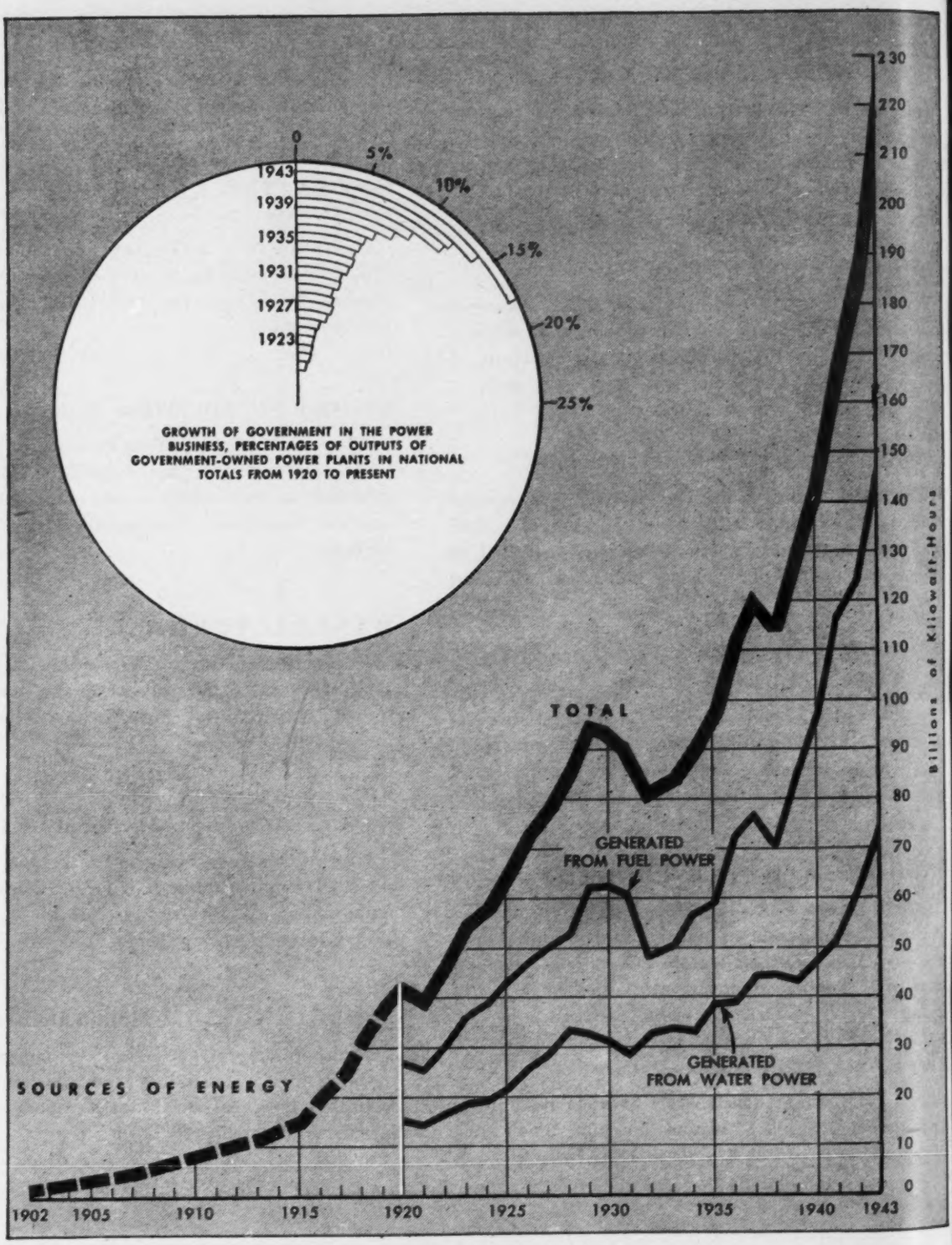
REA: 2 Billion Kw.-Hr. Input

Large increase accounted for by the addition of relatively small numbers of large customers. Growing number of customers per mile of line reflects efforts to connect new users to existing lines.

FINANCING: 371 Million Dollars

Slight increase over 1942. New capital about one tenth of 1942. Refunding operations increase over 1942 by 100 million dollars. Industry continues largely to finance itself.

221,000,000,000 Kw.-Hr. OUTPUT



Energy Production by Regions

(In Millions of Kw.-Hr.)

Region	1940			1941			1942			1943		
	Fuel Power	Water Power	Total	Fuel Power	Water Power	Total	Fuel Power	Water Power	Total	Fuel Power	Water Power	Total
N.E.	6,195	2,773	8,968	7,882	2,549	10,431	7,975	3,188	11,163	8,320	3,720	12,040
M.A.	28,662	7,721	36,383	34,029	7,283	41,312	35,363	9,506	44,869	41,000	9,880	50,880
E.N.C.	30,754	2,858	33,612	36,296	3,089	39,385	39,819	3,516	43,335	46,600	3,700	50,300
W.N.C.	6,787	1,694	8,481	7,240	2,732	9,972	7,583	3,035	10,618	8,620	3,010	11,630
S.A.	11,865	5,752	17,617	16,172	4,808	20,980	16,697	7,147	23,844	19,340	7,940	27,280
E.S.C.	2,413	6,058	8,471	3,914	6,172	10,086	4,300	8,394	12,694	4,840	10,260	15,100
W.S.C.	7,114	319	7,433	8,061	779	8,840	9,209	927	10,136	11,900	900	12,800
Mountain	1,774	6,770	8,544	1,546	7,713	9,959	1,744	9,047	10,792	1,760	11,140	12,900
Pacific	1,665	13,808	15,473	1,768	16,137	17,905	2,311	19,419	21,729	4,220	23,850	28,070
U.S.	97,232	47,753	144,985	116,908	51,262	168,170	125,002	64,179	189,181	146,600	74,400	221,000

Source: Federal Power Commission. * Estimated.

The first calendar year to exceed a hundred billion kilowatt-hour output was 1936. Seven years later the second hundred billion kilowatt-hour mark was passed. With its 221 billion kilowatt-hours 1943 passed 1942 by 17 percent. This rate of increase may be compared with 12.5 percent and 16.5 percent, respectively, for 1942 and 1941.

While the previous year showed the characteristic curve of declining output for the first four months and then a rise, last year was almost steady during the early months with a steady increase from May on.

Hydro contributed 33.7 percent of the total in 1943, just a shade under the 33.9 value in 1942. Both turned out to be "good water" years and helped to hold down the requirements for fuel and its transportation. Despite the preponderance of government-owned projects in the hydro output the privately owned electric utilities contributed more than four-fifths of the national generation but only 68 percent of the year's increase. Federal plants generated 11 percent of the country's total and municipals and co-operatives about 7 percent. The rest came from mining, manufacturing and railway enterprises.

Production of Electric Energy by Ownership

(In Millions of Kw.-Hr.)

Year	Privately Owned				Government Owned		
	Electric Utilities	Mining and Mfg.	Railways	Sub-total	Local†	Federal	Sub-total
1929	87,514	780	2,965	91,259	4,367	300	4,667
1930	86,108	790	2,750	89,648	4,538	465	5,003
1931	82,597	789	2,590	85,975	4,257	497	4,754
1932	74,488	596	2,388	77,472	4,460	445	4,905
1933	76,668	740	2,256	79,664	4,614	459	5,072
1934	82,079	1,193	2,355	85,627	4,822	357	5,179
1935	89,330	831	2,346	92,506	5,403	555	5,958
1936	102,293	667	2,198	105,159	5,950	1,072	7,023
1937	110,464	784	2,140	113,388	6,606	1,843	8,449
1938	104,090	857	2,012	106,959	6,693	3,029	9,722
1939	115,078	851	1,843	117,772	7,088	5,476	12,564
1940	125,411	908	1,323	127,642	8,758	8,584	17,342
1941	144,289	851	816	145,956	11,420	10,794	22,214
1942	158,052	621	876	159,549	12,739	16,893	29,633
1943*	179,850	670	840	181,360	15,300	24,340	39,640

Source: Federal Power Commission. * Estimated. † Includes cooperatives.

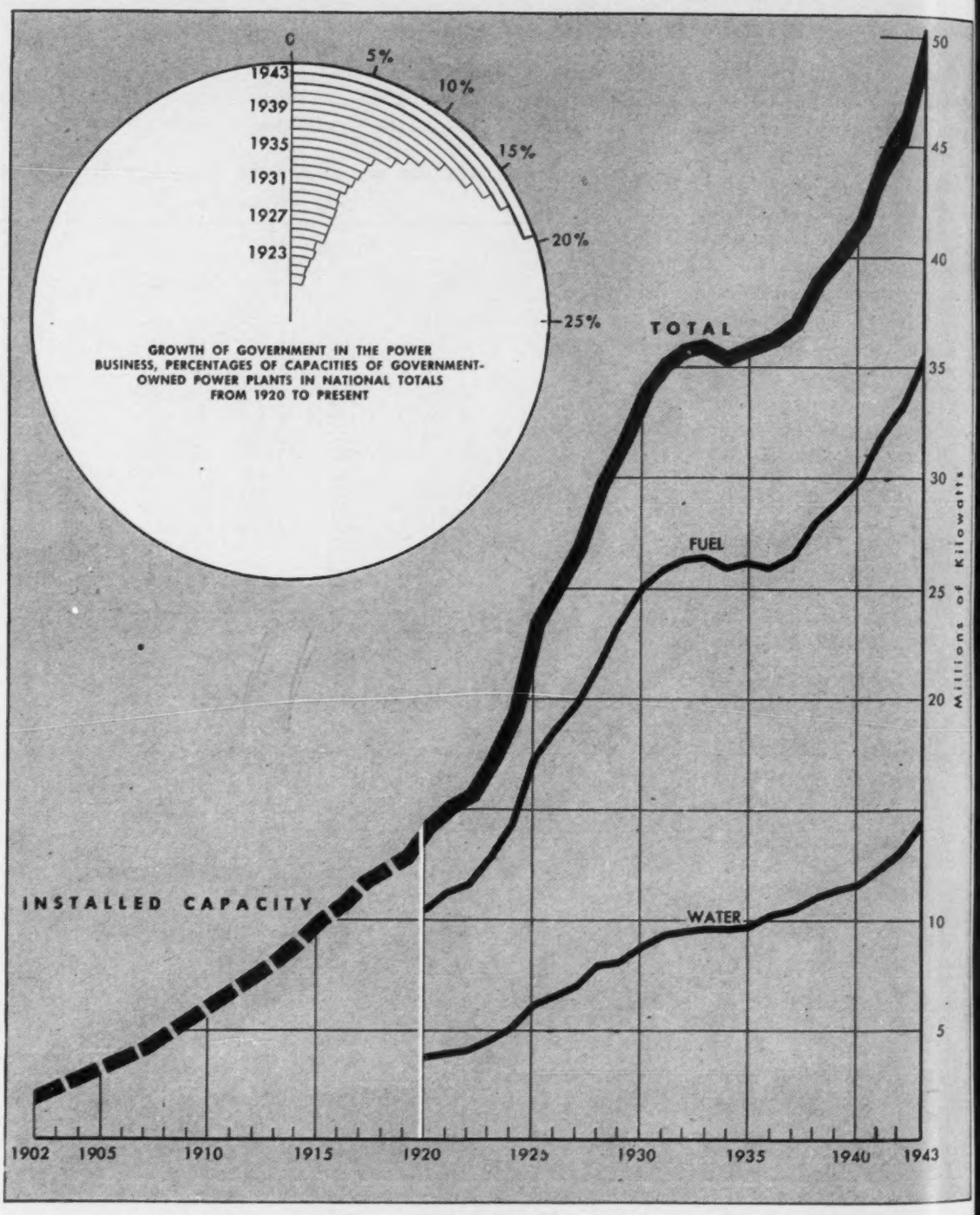
Source and Disposal of Energy

(In Millions of Kw.-Hr.)

Year	Generated from		Total Generation	Add Imports from Canada	Less Energy Used by Producer	Total for Distribution	Losses	Sales to Ultimate Consumers
	Fuel Power	Water Power						
1929	62,734	33,191	95,925	962	6,610	90,277	14,983	75,294
1930	62,914	31,738	94,652	1,084	6,269	89,467	14,561	74,906
1931	61,149	29,580	90,729	794	5,459	86,064	14,162	71,902
1932	49,055	33,322	82,377	446	5,248	77,575	13,864	63,711
1933	50,678	34,058	84,736	613	4,910	80,439	14,523	65,916
1934	57,093	33,713	90,806	893	5,499	86,200	15,118	71,082
1935	59,430	39,034	98,464	901	5,669	93,696	16,100	77,596
1936	72,665	39,516	112,181	1,054	5,826	107,409	17,365	90,044
1937	77,348	44,489	121,837	1,733	6,428	117,142	17,783	99,359
1938	71,847	44,834	116,681	1,867	6,990	111,558	17,826	93,731
1939	86,314	44,022	130,336	1,900	7,734	124,502	18,735	105,768
1940	97,232	47,753	144,985	937	7,268	138,654	20,011	118,643
1941	116,908	51,262	168,170	927	6,335	162,762	22,702	140,060
1942	125,002	64,179	189,181	1,448	6,611	184,018	24,611	159,407
1943*	146,600	74,400	221,000	1,540	10,940	211,600	25,600	186,000

Sources: Federal Power Commission and Edison Electric Institute. * Estimated.

49,442,000 Kw. CAPACITY



In the two full calendar years of war just completed the nation's power systems have increased their generating facilities by 13 percent with almost identically the same percentages of addition in 1943 as in 1942, 6.55 and 6.65 respectively. Further, the respective increases in hydro and fuel-power generation followed practically the same pattern, 8.35 percent (vs. 8.15 in 1942) for hydro, and 5.83 percent (vs. 5.31 in 1942) for steam. The new value of 14,112,000 kw. for hydro merely maintains its 28 percent fraction of the whole (28.6 in 1943 vs. 28.4 in 1942).

Governmental bodies, federal and local, own 19.4 percent of the national generating facilities; the federal government's 4,369,000 kw. represent 8.9 percent of the total, and this is, of course, mostly hydro. Municipals, power districts and co-operatives constitute the remaining 10.5 percent in publicly owned hands.

Of the privately owned capacity the electric utilities have 79.5 percent and only two-thirds of 1 percent rests with railways and manufacturing and mining establishments which engage in serving their local publics, either directly or by tie with the public service companies.

Again as in 1942 the bulk of the additions went to the South and the West Coast to serve the war needs concentrated there. The Northeastern quadrant of the country with 60.7 percent of the national total at the end of 1942 got only 34.5 percent of the 1943 increment. The other three quadrants have thereby grown from 39.3 percent to a present 40.7 percent. Regionally the percentage increases were as follows, in order of magnitude of growth: total, E.S.C., 17.4; Pac., 16.7, W.S.C., 9.1; E.N.C., 6.5; Mtn., 6.1; S.A., 6.0; M.A., 2.4; N.E., 1.7; W.N.C., 1.2; fuel-power, E.S.C., 18.5; Pac., 12.1; W.S.C., 10.5; S.A., 8.5; E.N.C., 6.7; M.A., 2.8; N.E., 2.3; Mtn., 1.5; W.N.C., 1.4; hydro, Pac., 19.0; E.S.C., 16.2; Mtn., 7.8; E.N.C., 3.0; S.A., 1.7; negligible elsewhere.

Generating Capacity by Ownership

(In Thousands of Kw.)

Year	Privately Owned				Government-Owned		
	Electric Utilities	Mining and Mfg.	Railways	Sub-total	Local†	Federal	Sub-total
1929	27,953	420	1,363	29,736	1,673	214	1,887
1930	30,285	438	1,232	31,956	1,873	226	2,099
1931	31,498	431	1,240	33,170	1,969	230	2,200
1932	32,033	388	1,216	33,638	2,122	232	2,354
1933	32,163	458	1,198	33,819	2,191	232	2,423
1934	31,547	449	1,223	33,220	2,283	288	2,571
1935	31,820	449	1,190	33,459	2,316	300	2,615
1936	31,787	447	1,036	33,270	2,492	803	3,295
1937	31,958	494	1,021	33,472	2,829	832	3,662
1938	33,246	559	991	34,796	3,090	1,156	4,246
1939	33,908	559	896	35,363	3,304	1,650	4,955
1940	34,399	603	499	35,501	4,195	1,944	6,138
1941	36,041	601	476	37,118	4,603	2,371	6,974
1942	37,442	267‡	476	38,186	5,005	3,216	8,221
1943*	39,136	261	476	39,873	5,200	4,369	9,569

Source: Federal Power Commission. * Estimated. † Includes cooperatives. ‡ Adjustment.

Installed Capacity

(In Thousands of Kw.)

Year	Type of Prime Mover		
	Fuel	Water	Total
1929	23,456	8,166	31,622
1930	25,114	8,941	34,055
1931	25,925	9,445	35,370
1932	26,408	9,583	35,991
1933	26,507	9,736	36,243
1934	26,049	9,742	35,791
1935	26,279	9,795	36,074
1936	26,128	10,436	36,564
1937	26,558	10,577	37,135
1938	27,976	11,066	39,042
1939	28,903	11,415	40,318
1940	29,964	11,675	41,639
1941	31,828	12,264	44,092
1942	33,381	13,025	46,407
1943*	35,330	14,112	49,442

Source: Federal Power Commission. *Estimated.

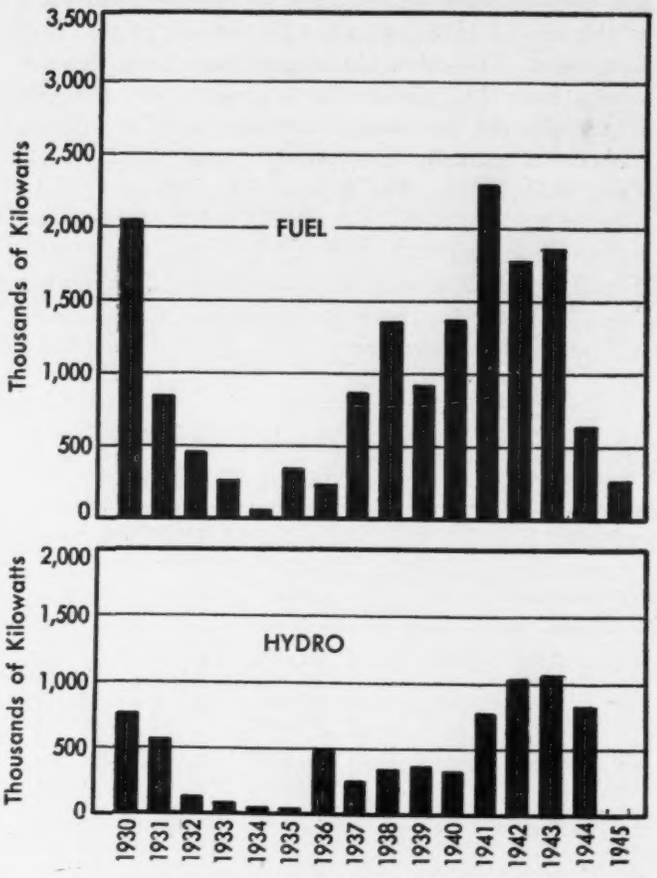
Generating Capacity by Regions

(In Thousands of Kw.)

Region	1940			1941			1942			1943*		
	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total
N.E.	2,187	876	3,063	2,295	873	3,168	2,467	904	3,371	2,524	906	3,430
M.A.	8,281	1,597	9,878	8,841	1,599	10,440	9,167	1,603	10,770	9,428	1,601	11,029
E.N.C.	8,773	716	9,489	9,383	716	10,099	9,808	729	10,537	10,468	751	11,219
W.N.C.	2,777	539	3,316	2,806	600	3,406	2,902	599	3,501	2,945	599	3,544
S.A.	3,031	2,140	5,171	3,392	2,164	5,556	3,680	2,210	5,889	3,993	2,248	6,241
E.S.C.	778	1,366	2,144	846	1,432	2,278	1,012	1,637	2,649	1,200	1,902	3,106
W.S.C.	1,951	153	2,104	1,970	279	2,249	2,070	301	2,371	2,288	301	2,589
Mountain	605	1,612	2,217	669	1,692	2,361	653	1,784	2,437	663	1,924	2,587
Pacific	1,578	2,675†	4,253	1,626	2,909	4,535	1,623	3,258	4,881	1,820	3,878	5,698
U.S.	29,964	11,675	41,639	31,828	12,264	44,092	33,382	13,025	46,407	35,330	14,112	49,442

Source: Federal Power Commission. * Estimated. † Includes a reduction of 131,000 kw. in rerating equipment from kva. to kw. basis.

4,700,000 Kw. NEW CAPACITY



New Capacity Added Each Year

as reported to Electrical World for the entire industry

Year	Kilowatts		
	Fuel	Hydro	Total
1929.....	2,081,085	249,200	2,330,285
1930.....	2,040,947	748,480	2,789,427
1931.....	836,500	566,500	1,403,000
1932.....	466,300	126,155	592,455
1933.....	251,025	95,325	346,350
1934.....	52,805	41,900	94,705
1935.....	347,140	38,950	386,090
1936.....	231,828	489,865	721,093
1937.....	873,414	245,346	1,118,760
1938.....	1,350,303	345,605	1,695,808
1939.....	914,680	370,150	1,284,830
1940.....	1,361,094	332,016	1,693,110
1941.....	2,292,215	786,250	3,078,375
1942.....	1,756,212	1,026,900	2,783,112
1943.....	1,835,180	1,088,900	2,924,080
1944*.....	630,000	835,900	1,465,900
1945*.....	287,500	.....	287,500

*Prospective.

Ever since 1941 power-generating additions have been a matter of federal priority or allocation. Statistically, the increments have not, as heretofore, been a result of free play of the forces of power demand and power supply. In particular, since March, 1942, the turbines for utility plants and government projects have been on an allocation basis. In June of that year the additional generating capacity fixed for the rest of the war was 5,300,000 kw., of which 2,970,000 kw. was dated for 1943 completion and 500,000 for 1944. The actual reported on-the-line figure of 2,924,080 kw. for 1943 shows close conformity with the then plans and allocation. But additional grants have already tripled the capacity in prospect for 1945, bringing it to 1,465,900 kw. instead of 500,000, both steam and hydro having been accorded more latitude.

With the exception of the priorities allocated to Pacific Gas & Electric, the hydro plants of 835,100 kw. for 1944 are all for government projects. The 610,000 kw. of steam is divided among eleven companies and one municipal plant mostly on or near the industrial areas of the Atlantic seaboard. The 287,500 kw. of steam power in prospect for 1945 is in much the same area except for 40,000 kw. destined for the South.

Prominence given to priorities, curtailment of construction and the general atmosphere of conservation attending devotion to war may easily have given the impression that utility capacity additions in 1943 were relatively small. The facts contradict this. The 1943 increment is almost as large as 1941, when we were hurrying to meet the foreseen war, and is largely surpassed only by the banner year of 1928 with a capacity addition of 3,455,500 kw.

Thus the actual addition of 2,924,250 kw., taken in conjunction with the 2,783,112 of 1942 and the 3,078,375 of 1941, totals to a shade more than the value of 8,690,099 kw. which had been projected when the war engulfed us.

This three-year enlargement of generating facilities is within 6 percent of the total added during the whole ten-year period of 1931-1940.

Generating Capacity Added in 1943

Steam

Private Companies	Kw. (Nameplate)
Alabama Power	100,000
American Gas & Electric	130,600
Arkansas Power & Light	25,000
Boston Edison	40,000
Carolina Power & Light	25,000
Central Power & Light	15,000
Cleveland Electric Illuminating	50,000
Columbus & Southern Ohio Electric	30,000
Commonwealth Edison	147,000
Consolidated Edison System	50,000
Consumers Power	50,000
Detroit Edison	75,000
Georgia Power	40,000
Gulf States Utilities	15,000
Houston Lighting & Power	30,000
Louisiana Power & Light	35,000
Minnesota Power & Light	20,000
Missouri Power & Light	5,000
Monongahela-West Penn Public Service	35,000
New Orleans Public Service	30,000
New York State Electric & Gas	35,000
Ohio Edison	35,000
Oklahoma Gas & Electric	20,000
Otertail Power	5 000
Pacific Gas & Electric	40,000
Pennsylvania Power & Light	31,250
Potomac Electric Power Company	50,000
Public Service of Colorado	*10,000
Public Service Electric & Gas	125,000
Rochester Gas & Electric	25,000
San Diego Gas & Electric	35,000
Southern California Edison	80,000
Texas Power & Light	25,000
Union Electric of Illinois	80,000
Virginia Public Service	21,000
Western United Gas and Electric Co.	12,500
Wisconsin Electric Power	80,000
Wisconsin Public Service	25,000
Total	1,682,350

Municipal and Other Public Plants	
Burbank, California	10,000
Jones-Onslow Electric Membership Corporation	5,000
Los Angeles, California	65,000
Tennessee Valley Authority	60,000
Total	140,000

Hydro

Private Companies	
Pacific Gas & Electric	22,000
Wisconsin-Michigan Power Co.	15,000
Woodstock Electric	500
Total	37,500

Municipal and Other Public Plants	
Bonneville Power Administration	582,000
Bureau of Reclamation	164,000
Fort Peck	35,000
Tennessee Valley Authority	270,400
Total	1,051,400

Internal Combustion

Private Companies	
Southeast Indiana Power Co.	4,800
Community Public Service	1,000
Black Hills Power & Light	1,080
Wisconsin Hydroelectric Power Co.	1,250
Total	8,130

Municipal and Other Public Plants	
Hudson, Massachusetts	1,600
Jacksonville, Illinois	1,400
Maquoketa, Iowa	1,700
Total	4,700

*Increase from turbine rebuild.

Generating Capacity to Be Added in 1944

Steam

Private Companies	Kw.
American Gas & Electric	170,000
Consolidated Gas, Electric Light & Power of Baltimore	50,000
Florida Power Corporation	25,000
New Bedford Gas & Edison Light Co.	7,500
Northern States Power	50,000
Ohio River Power	50,000
Pennsylvania Edison	25,000
Pennsylvania Electric	25,000
Public Service of Indiana	137,500
Southern Indiana Gas & Electric	20,000
Virginia Electric & Power	50,000
Total	610,000

Municipal and Other Public Plants	
San Antonio, Texas	20,000

Hydro

Municipal and Other Public Plants	
Bonneville Power Administration	108,000
Bureau of Reclamation	232,500
Pacific Gas & Electric	132,000
Tacoma, Washington	36,000
Tennessee Valley Authority	257,400
U. S. A. Engineer Corps	70,000
Total	835,900

Generating Capacity to Be Added in 1945

Steam

Private Companies	
New York State Electric & Gas	30,000
American Gas & Electric	100,000
Public Service of Indiana	60,000
Gulf Power	20,000
Mississippi Power Co.	20,000
Potomac Electric Power Co.	50,000
New Hampshire Gas & Electric	7,500
Total	287,500

Fuel prime-mover additions of 1,835,180 kw. in 1943 slightly exceeded the 1942 figure, but fell quite a bit short of 1941. On the other hand the hydro increment was larger each year; in fact, it has been showing a steady growth in annual additions ever since the sharp resumption following the three slump years of 1933-35.

Stepped-up industrial production of war materials has taxed the existing generating capacity as never before. This can be sensed from the output and peak data elsewhere in these pages. But by crowding the prior facilities, bringing semi-retired facilities back to service and having the authorized additions to draw upon, the power industry has met the requirements without shortage or acute distress at any point. Pooling of area facilities and stepped-up loadings on individual units has made this possible to the degree contemplated by WPB in its control of generating capacity additions.

What this all means to the immediate future of the industry is contingent partly upon what the load will be and partly on the extent to which over-age units will be retired as soon as they have done their war duty. There is also the question whether the industry will not want to resume a measurably larger margin of reserve than has been possible during the war.

On this basis the prospective increases set down for 1944 and 1945 reflect only the official authorizations on a war-stringency level and not at all what would be accelerated if peace should come, even if only in Europe. Incidentally, if 1944 turns out as now indicated, it will be the first year in the industry's history in which the installation of new hydro capacity (835,000 kw.) will exceed the steam of one percent of the total generating capacity added.

Internal combustion has been a substantially larger factor than in 1942, but its latest figure of 12,830 kw. is still much less than one-half of one percent of the total added.

Totals for 1943

Kilowatts	Private Companies	Municipal and Federal	Total
Steam	1,682,350	140,000	1,822,350
Hydro	37,500	1,051,400	1,088,900
Internal Combustion	8,130	4,700	12,830
Total	1,727,980	1,196,100	2,924,080

Totals for 1944

Kilowatts	Private	Municipal and Federal	Total
Steam	610,000	20,000	630,000
Hydro	.....	835,900	835,900
Total	610,000	855,900	1,465,900

Totals for 1945

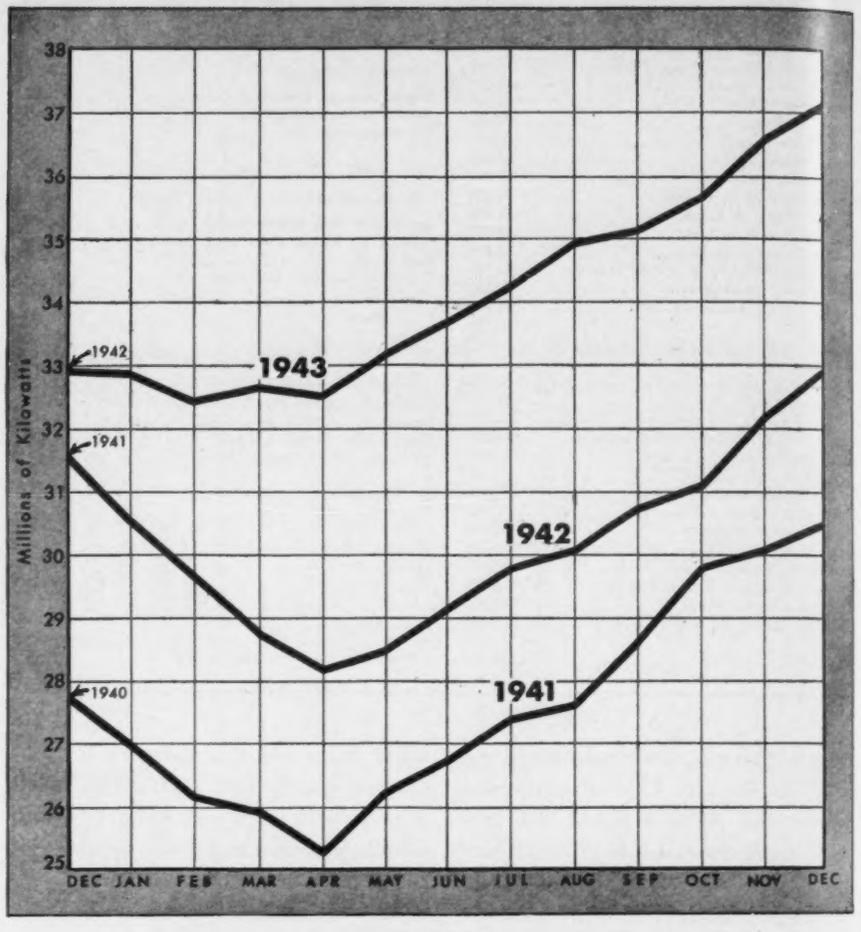
Kilowatts	Private Companies	Municipal and Federal	Total
Steam	287,500	.....	287,500
Hydro	.....	.....	.....
Total	287,500	.....	287,500

PEAKS and CAPACITIES

Entering the third year of war, the electric utilities of the United States can look forward with full confidence that they will carry the 1944 load without faltering. That confidence derives from two sources, the record of their performance so far under the strain of war and the reasonable expectation that the coming year will see a lessening in the rate of increase in demands for power.

Under this same title of "Peaks and Capacities" Electrical World last year ventured the prediction that the aggregate peak load reported by the Federal Power Commission for Class A utilities would not exceed 37,000,000 kw. in December, 1943. The accompanying table of margins of dependable capacities over peaks shows the figure of 37,130,000 kw. as our estimate of the 1943 peak made on the firmer footing of the ten months record through October.

It is again necessary to point out the disparity between the figure of 42,589,000 kw. of "dependable" capacity in the accompanying table and the 49,442,400 kw. of total capacity stated in several other places in this issue. As defined by the Federal Power Commission, the word "dependable" excludes much capacity that is perfectly capable of carrying load except under most extreme conditions of water scarcity or other limitation. Thus the December, 1943, margin of 14.7 percent of total dependable capacity over total peak load and the respective margins of the regions state a condition that, while narrowed from 1942, gives no cause for concern.



Behavior of monthly peak loads

This feeling of confidence is fortified by the many indications which are becoming more frequently apparent — cutbacks and stoppages of certain war productions, scarcities turning into surpluses, and, above all, the officially expressed expectation of end of the European phase of the war in 1944 —that the peak of total requirement of electricity supply capacity to serve the war load is passed or, at least, its rate of rise will be slowed from now on. This is to say that, so far as the war is concerned, the electric utilities will not be faced in 1944 with the possibilities of unprecedented demands that confronted them in 1942 and 1943.

Particularly effective in lowering the demand for power in 1944 will be reductions in production of metals by electric processes. Some of these reductions have already occurred and others will follow. At the end of December the War Production Board ordered the closing down of four aluminum pot lines and the possibility of cutting out eleven more lines within a few days later was mentioned in the newspaper report.

Over against the factors indicating a slowing-up of the rate of power demand growth there is to be recognized a modifying condition. This is the fact of greatly increased output of energy per unit

of capacity; in 1943 it was 4611 kw.-hr. per kw. as against 4181 in 1942 and 3923 in 1941. In other words, equipment is working harder and for longer hours and, presumably, its wear-out life is being shortened. How much or how little result from this there will be in terms of capacity lost is anyone's guess, but there is no reason to believe that such loss will be significant in 1944 or before the war emergency is over.

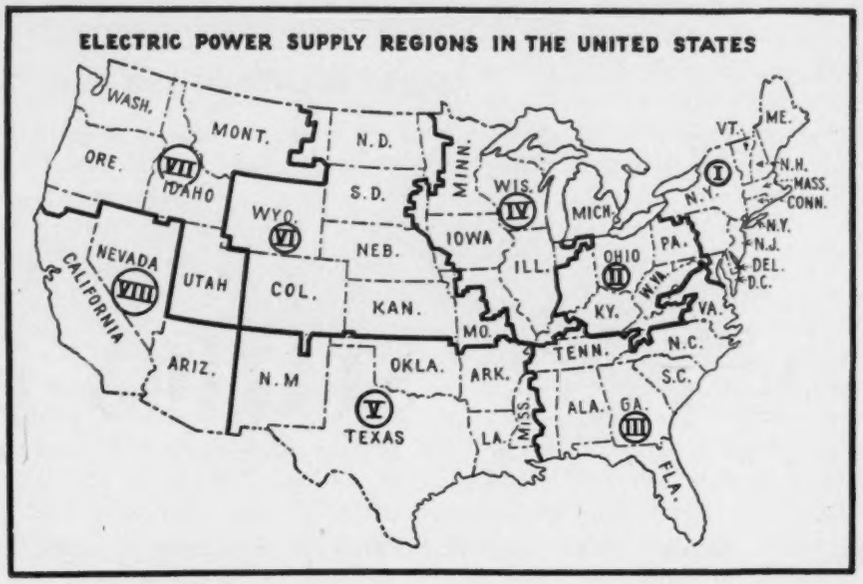
In the summer of 1942 an allocation of the War Production Board set a total of 500,000 kw. of new capacity to be installed in 1944. Instead, due largely to delay of capacity installation scheduled for 1943, additions in 1944, will amount to about three times that figure. Thus the less rapidly growing peak load in 1944 will be carried by a considerably enlarged dependable capacity.

To embark again on prophecy in the assumption that peak load will not increase so rapidly as in 1943 and that the nation will remain on war time, one might say that the 1944 December peak will not exceed 38,500,000 kw. To carry this load there will be an estimated dependable capacity of close to 44,000,000 kw. The margin of capacity standing by will thus be 14.3 percent, about the same as in 1943.

The regional picture of margins of capacities over peaks is more uniform in 1943 than in the two preceding years. The range between largest and smallest margins is narrowed to 23.4 percent as against 36.6 in 1942 and 43.8 in 1941. This reduction in range of margins is an apparent indication of the effect of control of capacity additions during the war years.

The chart of monthly peaks shows a curve shape for 1943 very different from those of the two previous years. The characteristic of decline with the disappearance of the holiday load at the turn of the year and with the lengthening of days of spring is almost entirely missing from the 1943 curve. Plain in this curve is the story of war production lengthening its astounding stride to the speed that has amazed the world. Probably the 1944 curve will show a closer resemblance to those of 1941 and 1942, assuming that a general plateau of production has now been reached.

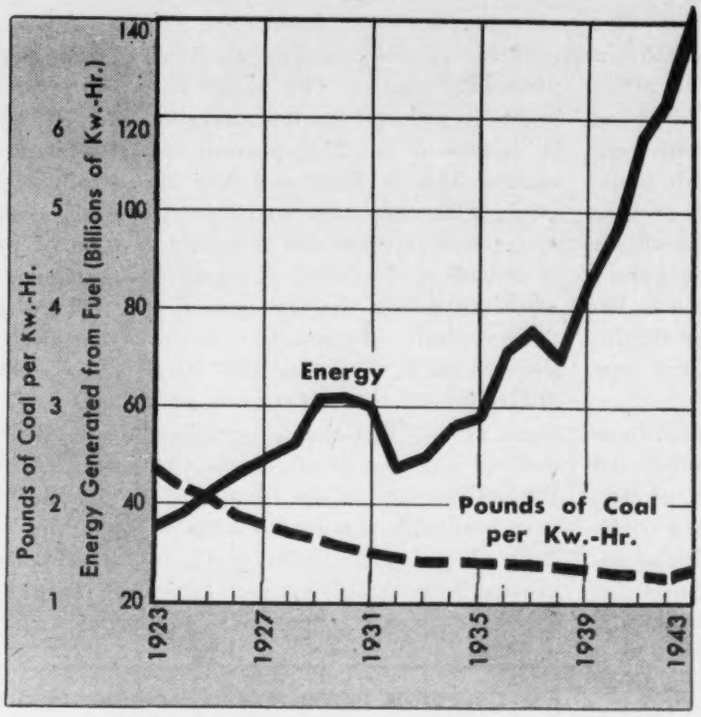
There has not been in the past year any major shortage of electric power. There were fears of shortages once or twice as loads approached close to available capacities here and there, but they turned out to be worries about troubles that never came. There should be less ground for such fears in the year ahead.



Margins of Dependable Capacities above Peaks

Regions	December, 1941			December, 1942			December, 1943†		
	Peaks	Dependable Capacities*	Percent Margins	Peaks	Dependable Capacities*	Percent Margins	Peaks	Dependable Capacities*	Percent Margins
I	9,789,240	11,613,160	18.6	9,613,076	11,952,294	24.2	10,620,000	12,210,000	15.0
II	6,513,688	7,715,440	18.4	6,848,359	8,092,832	18.3	7,720,000	8,503,000	10.2
III	3,837,155	4,036,329	5.2	4,363,683	4,877,227	11.7	4,830,000	5,399,000	11.8
IV	4,325,104	5,102,832	18.0	4,344,546	5,285,140	21.7	4,770,000	5,769,000	20.9
V	1,546,593	2,018,092	30.5	1,781,452	2,111,803	18.8	2,035,000	2,308,000	13.4
VI	785,180	1,169,895	49.0	848,647	1,215,134	43.3	925,000	1,236,000	33.6
VII	1,998,776	2,159,025	8.0	2,309,486	2,463,695	6.7	2,790,000	3,245,000	16.3
VIII	2,773,570	3,543,936	27.8	2,833,215	3,667,210	29.2	3,440,000	3,919,000	13.9
Total	31,569,306	37,358,709	18.3	32,942,464	39,665,335	20.4	37,130,000	42,589,000	14.7

* Includes reserves and net firm purchases. †Estimated by Electrical World on ten-month record in 1943. Source — Federal Power Commission.



Output from Fuel and Fuel Used

4,611 Kw.-Hr. per Kw. of Capacity

STATION ECONOMICS

Quite naturally the nation's stepped-up production for war needs resulted in more output from more generating capacity in 1943 than the power industry ever before had been called upon to contribute. Further, all of the facilities of the business were worked harder than ever before, as shown by the fact that the increase of 6½ percent in capacity was accompanied by a rise of nearly 17 percent in output.

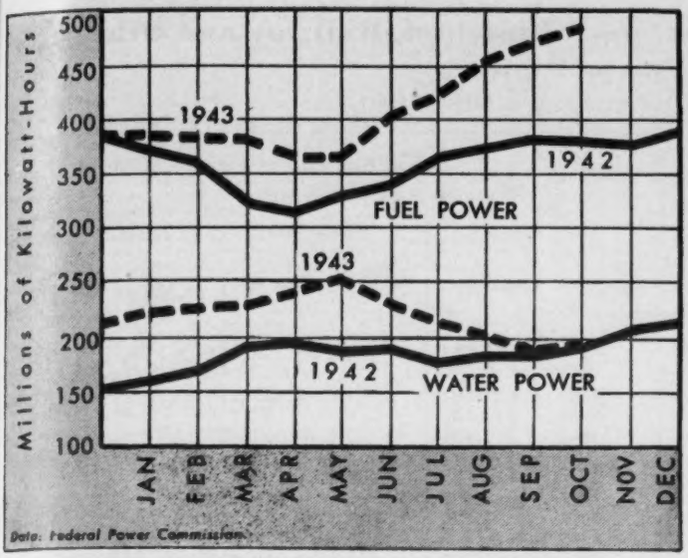
In fact, if the 3,035,000 additional kilowatts had been called upon to carry all the new output they would have had to work an impossible 10,484 hours to do it or else have been overloaded 20 percent continuously for every one of the 8,760 hours in the year.

Actually, however, all the 49,442,000 kilowatts participated in the total output of 221 billions of kilowatt-hours, and to accomplish the task they were worked on the average 4,611 hours at full tilt in

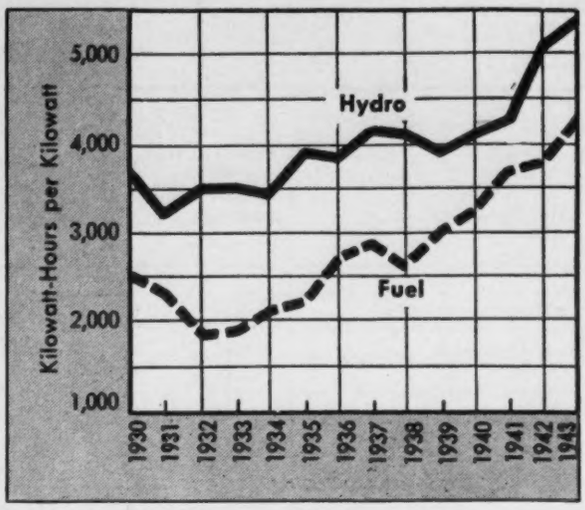
Output, Capacity, Average Use

Year	Energy Generated (Millions of Kw.-Hr.)			Generating Capacity at End of Year (Thousands of Kw.)			Output per Kw. of Ave. Cap. (Kw.-Hr.)		
	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total
1930.....	62,914	31,738	94,652	25,114	8,941	34,055	2,591	3,710	2,882
1931.....	61,149	29,580	90,729	25,925	9,445	35,370	2,396	3,218	2,614
1932.....	49,055	33,322	82,377	26,408	9,583	35,991	1,875	3,502	2,309
1933.....	50,678	34,058	84,736	26,507	9,736	36,243	1,915	3,526	2,346
1934.....	57,093	33,713	90,806	26,049	9,742	35,791	2,173	3,462	2,521
1935.....	59,430	39,034	98,464	26,279	9,795	36,074	2,271	3,996	2,740
1936.....	72,665	39,516	112,181	26,128	10,436	36,564	2,773	3,906	3,089
1937.....	77,348	44,489	121,837	26,558	10,577	37,135	2,936	4,234	3,306
1938.....	71,847	44,834	116,681	27,976	11,066	39,042	2,635	4,143	3,063
1939.....	86,314	44,022	130,336	28,903	11,415	40,318	3,035	3,916	3,285
1940.....	97,232	47,753	144,985	29,964	11,675	41,639	3,303	4,137	3,538
1941.....	116,908	51,262	168,170	31,828	12,264	44,092	3,784	4,283	3,923
1942.....	125,002	64,179	189,181	33,381	13,025	46,407	3,834	5,076	4,181
1943*....	190,215	74,400	221,000	35,330	14,112	49,442	4,267	5,483	4,611

Source: Federal Power Commission. * Estimated.



Average Daily Electrical Energy Production



Average Use of Capacity

the task. That outdoes the 1942 achievement, itself a record, by more than 10 percent.

The consequences of that duty imposed on generating capacity as a whole will be reflected in an acceleration of the obsolescence of older units called upon to relieve the newer ones from too much loading. Another result is that the pounds of coal (or coal equivalent of all fuels) used per kilowatt-hour are slightly more (1.34) than the previous low (1.31) established in 1942; the first time in the history of the industry when fuel economy does not show an annual improvement. However, some of this interruption in the steady upward trend in fuel efficiency can be attributed to difficulties in getting as good fuel during wartime as before.

Both steam and hydro worked more of the time to meet the demand, but, profiting by a good-water year, the hydro units were kept busy at capacity for many more hours (5,483) than ever before and so did steam-generated power. Additional hydro capacity of 8 1/3 percent brought the 1943 hydro to 28 percent of the total of steam and hydro and it carried more than its share (33 percent) of the output.

In 1943 the hours of use of fuel power capacity rose to 4,267 from 3,834 in 1942, an increase of 11.3 percent. The national plant factor on fuel power facilities was nearly 49 percent for 1943 as against around 62 for hydro capacity. All this pertains to average load and thus must not be interpreted as indicating a 51 percent margin of steam capacity to meet the peaks.

The industry held its consumption of oil—a critical war necessity—to no more than the 1942 usage, and that was a fourth less than in 1941. To accomplish this much-desired objective the power industry increased its use of gas 20 percent to 288 billion cubic feet and its use of coal only 12 percent. Thus the 11 percent increase in output from fuel plants was also obtained with no greater increase in use of coal despite the "drafting" of many of the older and less efficient generating units.

Natural gas is showing a steady increase in use as fuel for generating steam for turbines. The consumption of gas is now just six times what it was in 1924 and nearly twice it was only seven years ago.

Coal equivalents used in calculating the national average of 1.34 pounds of coal burned per kilowatt-hour produced are 23,200 cu. ft. of natural gas and 3.42 barrels of oil per ton of coal on the assumption that the average heat content of coal burned is 11,600 B.t.u. per pound.

Output From Fuel and Oil Used

Year	Energy Generated from Fuel† (Millions of Kw.-Hr.)	Fuel Consumed				
		Coal (Millions of Tons)	Oil (Millions of Bbl.)	Gas (Billions of Cu. Ft.)	†† Coal Equiv. (Millions of Tons)	Pounds of Coal per Kw.-Hr.†
1924..	38,806	37.56	16.64	48.47	42.69	2.20
1929..	62,295	44.93	10.19	112.62	52.64	1.69
1932..	48,931	30.30	7.97	107.84	36.70	1.50
1933..	50,546	30.58	9.95	102.73	37.15	1.47
1935..	59,176	34.16	11.38	125.24	43.20	1.46
1936..	72,188	42.03	14.12	156.08	51.99	1.44
1937..	76,883	44.77	14.14	171.27	55.14	1.43
1938..	71,525	40.21	13.08	170.69	50.56	1.41
1939..	85,800	46.22	17.42	191.13	59.51	1.39
1940..	96,609	53.40	16.77	183.16	65.14	1.35
1941..	116.167	64.76	20.25	205.16	77.99	1.34
1942..	124,401	68.42	15.28	238.74	81.44	1.31
1943*.	140,215	76.95	15.28	287.94	93.83	1.34

Source: Federal Power Commission. *Twelve months ended October 31
† Output by use of wood not included. †† Coal plus oil plus gas.

Generating Rating—Central Stations, Municipal, Railway and Other Utility Power Plants

Preliminary as of November 1, 1943

Division and State	Number of Companies	Number of Plants	Total Capacity Kilowatts	Generator Capacity in Kilowatts of Plants Operated by [a]					
				Water Power		Steam Power		Internal Combustion Engines	
				No. Plants	Capacity	No. Plants	Capacity	No. Plants	Capacity
United States	[b]1,795	4,098	48,658,527	1,566	13,821,813	1,193	33,778,641	1,339	1,058,073
New England	137	348	3,390,066	242	905,701	82	2,459,710	24	24,655
Maine	26	87	340,144	68	249,637	8	87,240	11	3,267
New Hampshire	14	55	314,915	46	232,905	6	80,430	3	1,580
Vermont	24	79	179,469	70	[c]165,027	7	13,750	2	692
Massachusetts	49	81	1,441,617	35	166,332	41	1,264,290	5	10,995
Rhode Island	6	11	284,721	4	3,250	5	278,450	2	3,021
Connecticut	18	35	829,200	19	88,550	15	735,550	1	5,100
Middle Atlantic	139	408	10,962,558	223	1,603,448	151	9,318,702	34	40,408
New York	74	249	5,974,872	181	1,171,143	52	4,777,475	16	26,254
New Jersey	15	27	1,578,187	4	7,610	18	1,566,640	5	3,937
Pennsylvania	50	132	3,409,499	38	424,695	81	2,974,587	13	10,217
East North Central	331	699	10,911,019	301	749,685	266	10,034,001	132	127,333
Ohio	73	109	3,097,142	7	12,125	81	3,068,219	21	16,798
Indiana	56	90	1,377,621	21	35,494	52	1,323,095	17	19,032
Illinois	65	102	2,922,945	13	52,166	65	2,847,422	24	23,357
Michigan	67	202	2,389,570	132	369,675	33	1,973,325	37	46,570
Wisconsin	70	196	1,123,741	128	280,225	35	821,940	33	21,576
West North Central	479	889	3,538,295	144	598,403	230	2,574,478	515	365,414
Minnesota	79	160	797,752	49	156,404	51	594,124	60	47,224
Iowa	98	183	743,527	32	131,223	50	520,415	101	91,889
Missouri	71	112	863,320	8	158,370	33	649,243	71	55,707
North Dakota	18	44	96,157	.....	.....	17	85,338	27	10,819
South Dakota	41	71	92,080	5	3,270	11	55,112	55	33,698
Nebraska	85	181	416,559	42	142,255	34	220,266	105	54,038
Kansas	87	138	528,900	8	6,881	34	449,980	96	72,039
South Atlantic	165	418	6,199,443	165	2,210,287	135	3,897,405	118	91,751
Delaware	7	8	38,912	.....	.....	4	33,200	4	5,712
Maryland	13	30	804,879	3	271,325	13	523,055	14	10,499
District of Columbia	2	3	408,000	1	3,000	2	405,000	.....	.....
Virginia	29	72	685,276	37	181,444	17	489,490	18	14,342
West Virginia	16	41	1,000,238	12	100,980	18	894,380	11	4,878
North Carolina	34	86	1,337,238	52	647,100	22	679,721	12	10,417
South Carolina	16	44	792,548	28	650,723	10	137,330	6	4,495
Georgia	16	57	666,731	28	343,022	23	321,375	6	2,334
Florida	32	77	465,621	4	12,693	26	413,854	47	39,074
East South Central	70	174	2,956,715	38	1,756,950	80	1,175,357	56	24,408
Kentucky	17	41	460,147	3	110,860	29	346,160	9	3,127
Tennessee	17	40	1,084,043	22	711,687	13	370,520	5	1,836
Alabama	11	40	1,318,372	13	934,403	18	379,360	9	4,609
Mississippi	25	53	94,153	.....	.....	20	79,317	33	14,836
West South Central	190	422	2,515,601	35	301,097	106	1,994,378	281	220,126
Arkansas	30	50	183,175	5	67,008	17	98,330	28	17,837
Louisiana	37	65	479,203	.....	.....	11	432,670	54	46,533
Oklahoma	57	106	466,784	4	59,224	25	352,778	77	54,782
Texas	66	201	1,386,439	26	174,865	53	1,110,600	122	100,974
Mountain	186	428	2,592,629	200	1,926,555	79	558,148	149	107,926
Montana	19	38	373,824	22	358,473	5	12,318	11	3,033
Idaho	20	61	270,433	45	266,100	2	620	14	3,713
Wyoming	28	50	89,340	14	49,690	15	34,207	21	5,443
Colorado	40	87	355,602	30	90,385	28	248,499	29	16,718
New Mexico	21	45	146,610	5	25,157	12	99,879	28	21,574
Arizona	22	55	676,639	15	540,790	13	92,325	27	43,524
Utah	27	75	168,897	58	92,185	3	66,250	14	10,462
Nevada	9	17	511,284	11	503,775	1	4,050	5	3,459
Pacific	98	312	5,592,201	218	3,769,687	64	1,766,462	30	56,052
Washington	31	69	1,610,430	48	1,404,535	14	203,870	7	2,025
Oregon	31	79	854,137	52	658,727	18	190,640	9	4,770
California	36	164	3,127,634	118	1,706,425	32	1,371,952	14	49,257

[a] For the approximately 185 combination plants each type of prime mover is counted as a separate plant.
[b] Total includes 94 duplications because of utilities having generating plants in more than one state.
[c] Includes 1,000 kilowatts wind power. Source: Federal Power Commission.

Increase Despite War
CUSTOMERS

Less than 0.6 percent increase in total number of electric utility customers would not, in previous years, have been anything to crow about. But for the year of war, 1943, when most statistics of so-called normal increase have either halted their upward movements or taken nose dives, even 0.6 percent of maintained growth is noteworthy.

In 1942 the decline in commercial and industrial customers was 103,268, 2.3 percent, from 1941. The estimated decline in 1943, 84,085, 1.9 percent, is less, but does not justify any great confidence that the mortality among small business concerns is decreasing. Considering the natural tendency of estimates toward the favorable view, it is probable that the actual figures for 1943, which will not be available until later, will show the 1.9 percent figure of decline to be too low.

It is to be noted that declines in numbers of commercial and industrial customers occurred in 1943 in every geographical region except one, the Mountain region, where industrialization is thin and the effects of war on local business activities are less than in the others.

Evidences of population shifts in 1942 could be seen in the much larger increases in number of residential customers in some regions than in others, but there were no cases of actual declines to be taken as incontrovertible testimony. At first glance it seems that such testimony can be taken from the 1943 figures, which in the Middle Atlantic and East South Central regions show respective decreases of 78,210 and 4,211. But in each of these regions there are large increases in numbers of rural customers, leading to the suspicion that the declines in numbers of residential customers represent shifts of customers from urban to rural rate schedules more largely than they do actual removals of people from the regions. Shifts between rate schedules, although in the reverse direction, rural to urban, are to be seen in the five regions where reductions in numbers of rural customers appear. Thus one is driven back to the variations in increases of numbers of domestic customers —that is, more rapid growths in some than in others— as indicators of shifts of population between the various regions.

On this basis it appears that the movement of people into the East North Central, South Atlantic, West South Central and Pacific regions continued through 1943, although in considerably less volume than in 1942. Which seems not unreasonable in view of the fact that the period of expansion of war production facilities has passed.

Central Station Customers at End of Year*

	United States	New England	Middle Atlantic	East No. Central	West No. Central	South Atlantic	East So. Central	West So. Central	Mountain	Pacific
Total Customers										
1943	32,395,000	2,569,500	7,986,700	7,554,800	3,064,800	3,213,900	1,437,700	2,139,100	966,200	3,473,300
1942	32,210,440	2,566,275	8,017,449	7,492,246	3,049,592	3,183,189	1,401,100	2,117,927	960,927	3,421,735
Change	184,560	3,225	−30,749	62,554	15,208	30,711	36,600	21,173	5,273	51,565
Rural Customers†										
1943	1,182,300	9,000	117,000	305,000	116,700	89,100	116,500	93,600	17,900	317,500
1942	1,095,512	17,238	31,215	302,166	125,336	101,551	72,870	110,022	22,415	312,699
Change	86,788	−8,238	86,785	2,834	−8,636	−12,451	43,630	−16,422	−4,515	4,801
Residential Customers										
1943	26,817,700	2,227,000	6,755,000	6,360,000	2,469,000	2,674,000	1,137,000	1,725,000	798,000	2,672,700
1942	26,620,456	2,205,200	6,833,210	6,292,018	2,441,382	2,624,002	1,141,211	1,680,610	788,620	2,614,203
Change	197,244	21,800	−78,210	67,982	27,618	49,998	−4,211	44,390	9,380	58,497
Commercial & Industrial										
1943	4,285,300	326,100	1,095,200	856,000	467,500	440,100	174,500	312,000	147,630	466,270
1942	4,369,385	336,688	1,127,273	874,018	470,985	445,728	176,622	315,035	145,054	477,982
Change	−84,085	−10,588	−32,073	−18,018	−3,485	−5,628	−2,122	−3,035	2,576	−11,712
Municipal, Rail & Miscellaneous										
1943	109,700	7,400	19,500	23,800	11,600	10,700	8,700	8,500	2,670	16,830
1942	125,087	7,149	25,751	24,044	11,889	11,908	10,397	12,260	4,838	16,851
Change	−15,387	251	−6,251	−244	−289	−1,208	−1,697	−3,760	−1,168	−21

*1943 Estimated. †Customers served on specific rural rates. Rural customers served on urban rates not included.

Generating Rating—Central Stations, Municipal, Railway and Other Utility Power Plants

Preliminary as of November 1, 1943

Division and State	Number of Companies	Number of Plants	Total Capacity Kilowatts	Generator Capacity in Kilowatts of Plants Operated by [a]					
				Water Power		Steam Power		Internal Combustion Engines	
				No. Plants	Capacity	No. Plants	Capacity	No. Plants	Capacity
United States	[b]1,795	4,098	48,658,527	1,566	13,821,813	1,193	33,778,641	1,339	1,058,073
New England	137	348	3,390,066	242	905,701	82	2,459,710	24	24,655
Maine	26	87	340,144	68	249,637	8	87,240	11	3,267
New Hampshire	14	55	314,915	46	232,905	6	80,430	3	1,580
Vermont	24	79	179,469	70	[c]165,027	7	13,750	2	692
Massachusetts	49	81	1,441,617	35	166,332	41	1,264,290	5	10,995
Rhode Island	6	11	284,721	4	3,250	5	278,450	2	3,021
Connecticut	18	35	829,200	19	88,550	15	735,550	1	5,100
Middle Atlantic	139	408	10,962,558	223	1,603,448	151	9,318,702	34	40,408
New York	74	249	5,974,872	181	1,171,143	52	4,777,475	16	26,254
New Jersey	15	27	1,578,187	4	7,610	18	1,566,640	5	3,937
Pennsylvania	50	132	3,409,499	38	424,695	81	2,974,587	13	10,217
East North Central	331	699	10,911,019	301	749,685	266	10,034,001	132	127,333
Ohio	73	109	3,097,142	7	12,125	81	3,068,219	21	16,798
Indiana	56	90	1,377,621	21	35,494	52	1,323,095	17	19,032
Illinois	65	102	2,922,945	13	52,166	65	2,847,422	24	23,357
Michigan	67	202	2,389,570	132	369,675	33	1,973,325	37	46,570
Wisconsin	70	196	1,123,741	128	280,225	35	821,940	33	21,576
West North Central	479	889	3,538,295	144	598,403	230	2,574,478	515	365,414
Minnesota	79	160	797,752	49	156,404	51	594,124	60	47,224
Iowa	98	183	743,527	32	131,223	50	520,415	101	91,889
Missouri	71	112	863,320	8	158,370	33	649,243	71	55,707
North Dakota	18	44	96,157	.....	.....	17	85,338	27	10,819
South Dakota	41	71	92,080	5	3,270	11	55,112	55	33,698
Nebraska	85	181	416,559	42	142,255	34	220,266	105	54,038
Kansas	87	138	528,900	8	6,881	34	449,980	96	72,039
South Atlantic	165	418	6,199,443	165	2,210,287	135	3,897,405	118	91,751
Delaware	7	8	38,912	.....	.....	4	33,200	4	5,712
Maryland	13	30	804,879	3	271,325	13	523,055	14	10,499
District of Columbia	2	3	408,000	1	3,000	2	405,000	.....	.....
Virginia	29	72	685,276	37	181,444	17	489,490	18	14,342
West Virginia	16	41	1,000,238	12	100,980	18	894,380	11	4,878
North Carolina	34	86	1,337,238	52	647,100	22	679,721	12	10,417
South Carolina	16	44	792,548	28	650,723	10	137,330	6	4,495
Georgia	16	57	666,731	28	343,022	23	321,375	6	2,334
Florida	32	77	465,621	4	12,693	26	413,854	47	39,074
East South Central	70	174	2,956,715	38	1,756,950	80	1,175,357	56	24,408
Kentucky	17	41	460,147	3	110,860	29	346,160	9	3,127
Tennessee	17	40	1,084,043	22	711,687	13	370,520	5	1,836
Alabama	11	40	1,318,372	13	934,403	18	379,360	9	4,609
Mississippi	25	53	94,153	.....	.....	20	79,317	33	14,836
West South Central	190	422	2,515,601	35	301,097	106	1,994,378	281	220,126
Arkansas	30	50	183,175	5	67,008	17	98,330	28	17,837
Louisiana	37	65	479,203	.....	.....	11	432,670	54	46,533
Oklahoma	57	106	466,784	4	59,224	25	352,778	77	54,782
Texas	66	201	1,386,439	26	174,865	53	1,110,600	122	100,974
Mountain	186	428	2,592,629	200	1,926,555	79	558,148	149	107,926
Montana	19	38	373,824	22	358,473	5	12,318	11	3,033
Idaho	20	61	270,433	45	266,100	2	620	14	3,713
Wyoming	28	50	89,340	14	49,690	15	34,207	21	5,443
Colorado	40	87	355,602	30	90,385	28	248,499	29	16,718
New Mexico	21	45	146,610	5	25,157	12	99,879	28	21,574
Arizona	22	55	676,639	15	540,790	13	92,325	27	43,524
Utah	27	75	168,897	58	92,185	3	66,250	14	10,462
Nevada	9	17	511,284	11	503,775	1	4,050	5	3,459
Pacific	98	312	5,592,201	218	3,769,687	64	1,766,462	30	56,052
Washington	31	69	1,610,430	48	1,404,535	14	203,870	7	2,025
Oregon	31	79	854,137	52	658,727	18	190,640	9	4,770
California	36	164	3,127,634	118	1,706,425	32	1,371,952	14	49,257

[a] For the approximately 185 combination plants each type of prime mover is counted as a separate plant.
[b] Total includes 94 duplications because of utilities having generating plants in more than one state.
[c] Includes 1,000 kilowatts wind power. Source: Federal Power Commission.

Increase Despite War
CUSTOMERS

Less than 0.6 percent increase in total number of electric utility customers would not, in previous years, have been anything to crow about. But for the year of war, 1943, when most statistics of so-called normal increase have either halted their upward movements or taken nose dives, even 0.6 percent of maintained growth is noteworthy.

In 1942 the decline in commercial and industrial customers was 103,268, 2.3 percent, from 1941. The estimated decline in 1943, 84,085, 1.9 percent, is less, but does not justify any great confidence that the mortality among small business concerns is decreasing. Considering the natural tendency of estimates toward the favorable view, it is probable that the actual figures for 1943, which will not be available until later, will show the 1.9 percent figure of decline to be too low.

It is to be noted that declines in numbers of commercial and industrial customers occurred in 1943 in every geographical region except one, the Mountain region, where industrialization is thin and the effects of war on local business activities are less than in the others.

Evidences of population shifts in 1942 could be seen in the much larger increases in number of residential customers in some regions than in others, but there were no cases of actual declines to be taken as incontrovertible testimony. At first glance it seems that such testimony can be taken from the 1943 figures, which in the Middle Atlantic and East South Central regions show respective decreases of 78,210 and 4,211. But in each of these regions there are large increases in numbers of rural customers, leading to the suspicion that the declines in numbers of residential customers represent shifts of customers from urban to rural rate schedules more largely than they do actual removals of people from the regions. Shifts between rate schedules, although in the reverse direction, rural to urban, are to be seen in the five regions where reductions in numbers of rural customers appear. Thus one is driven back to the variations in increases of numbers of domestic customers —that is, more rapid growths in some than in others— as indicators of shifts of population between the various regions.

On this basis it appears that the movement of people into the East North Central, South Atlantic, West South Central and Pacific regions continued through 1943, although in considerably less volume than in 1942. Which seems not unreasonable in view of the fact that the period of expansion of war production facilities has passed.

Central Station Customers at End of Year*

	United States	New England	Middle Atlantic	East No. Central	West No. Central	South Atlantic	East So. Central	West So. Central	Mountain	Pacific
Total Customers										
1943	32,395,000	2,569,500	7,986,700	7,554,800	3,064,800	3,213,900	1,437,700	2,139,100	966,200	3,473,300
1942	32,210,440	2,566,275	8,017,449	7,492,246	3,049,592	3,183,189	1,401,100	2,117,927	960,927	3,421,735
Change	184,560	3,225	−30,749	62,554	15,208	30,711	36,600	21,173	5,273	51,565
Rural Customers†										
1943	1,182,300	9,000	117,000	305,000	116,700	89,100	116,500	93,600	17,900	317,500
1942	1,095,512	17,238	31,215	302,166	125,336	101,551	72,870	110,022	22,415	312,699
Change	86,788	−8,238	86,785	2,834	−8,636	−12,451	43,630	−16,422	−4,515	4,801
Residential Customers										
1943	26,817,700	2,227,000	6,755,000	6,360,000	2,469,000	2,674,000	1,137,000	1,725,000	798,000	2,672,700
1942	26,620,456	2,205,200	6,833,210	6,292,018	2,441,382	2,624,002	1,141,211	1,680,610	788,620	2,614,203
Change	197,244	21,800	−78,210	67,982	27,618	49,998	−4,211	44,390	9,380	58,497
Commercial & Industrial										
1943	4,285,300	326,100	1,095,200	856,000	467,500	440,100	174,500	312,000	147,630	466,270
1942	4,369,385	336,688	1,127,273	874,018	470,985	445,728	176,622	315,035	145,054	477,982
Change	−84,085	−10,588	−32,073	−18,018	−3,485	−5,628	−2,122	−3,035	2,576	−11,712
Municipal, Rail & Miscellaneous										
1943	109,700	7,400	19,500	23,800	11,600	10,700	8,700	8,500	2,670	16,830
1942	125,087	7,149	25,751	24,044	11,889	11,908	10,397	12,260	4,838	16,851
Change	−15,387	251	−6,251	−244	−289	−1,208	−1,697	−3,760	−1,168	−21

*1943 Estimated. †Customers served on specific rural rates. Rural customers served on urban rates not included.

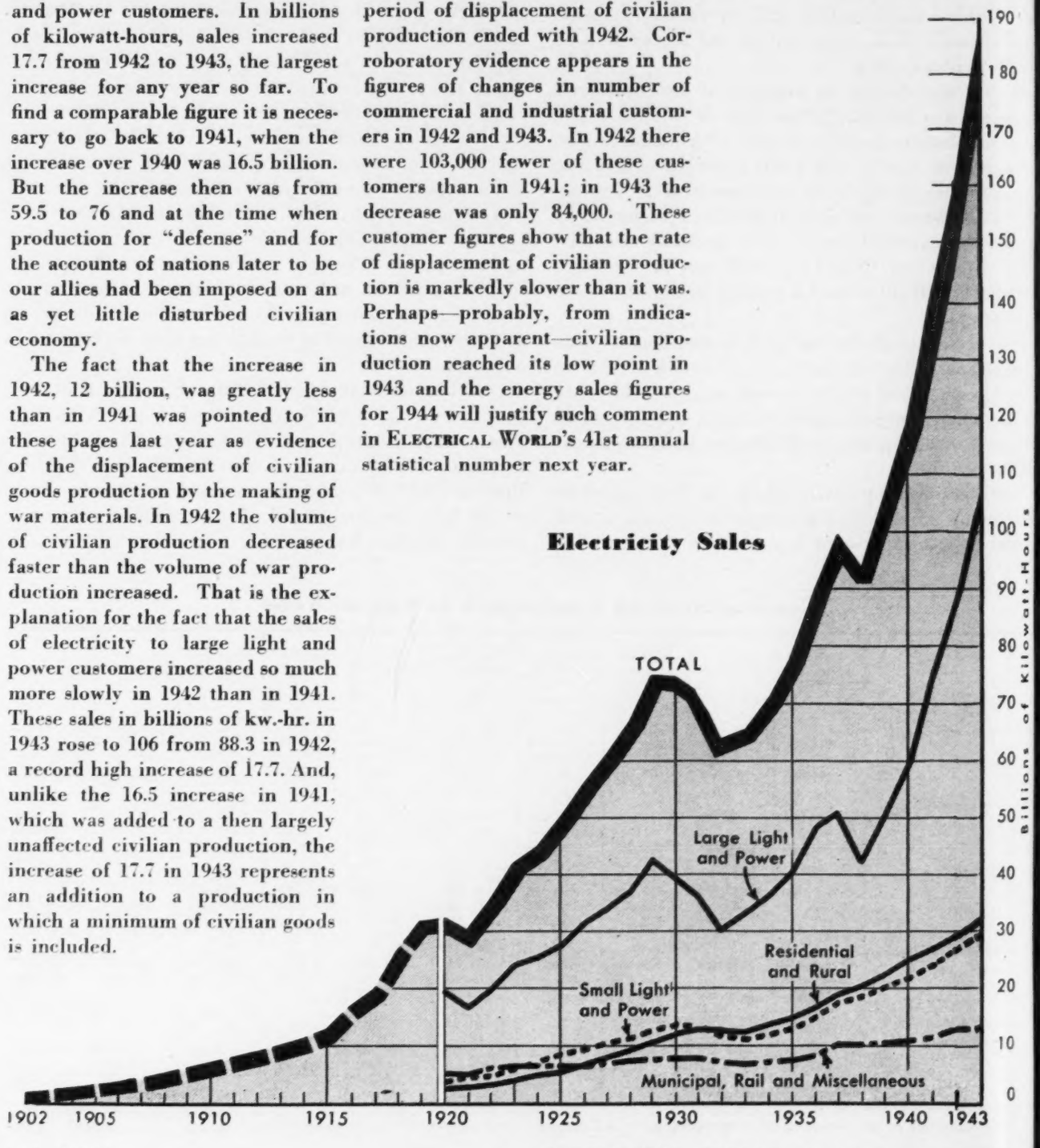
186,000,000,000 Kw.-Hr. ENERGY SALES

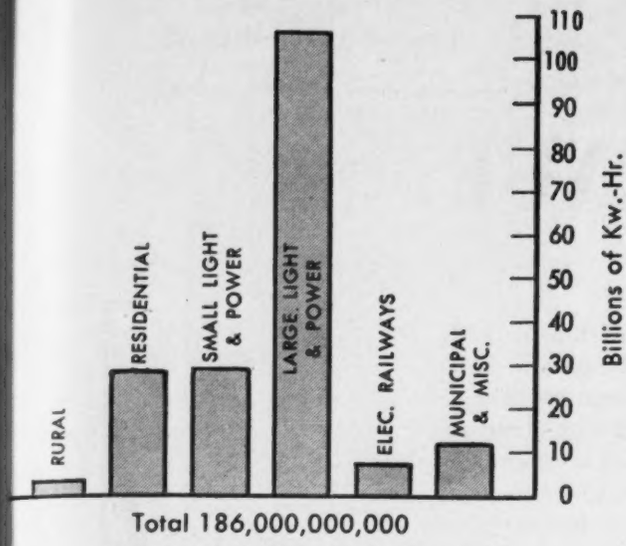
That American industry got well into its stride in war production in 1943 is plainly apparent in the record of energy sales to large light and power customers. In billions of kilowatt-hours, sales increased 17.7 from 1942 to 1943, the largest increase for any year so far. To find a comparable figure it is necessary to go back to 1941, when the increase over 1940 was 16.5 billion. But the increase then was from 59.5 to 76 and at the time when production for "defense" and for the accounts of nations later to be our allies had been imposed on an as yet little disturbed civilian economy.

The fact that the increase in 1942, 12 billion, was greatly less than in 1941 was pointed to in these pages last year as evidence of the displacement of civilian goods production by the making of war materials. In 1942 the volume of civilian production decreased faster than the volume of war production increased. That is the explanation for the fact that the sales of electricity to large light and power customers increased so much more slowly in 1942 than in 1941. These sales in billions of kw.-hr. in 1943 rose to 106 from 88.3 in 1942, a record high increase of 17.7. And, unlike the 16.5 increase in 1941, which was added to a then largely unaffected civilian production, the increase of 17.7 in 1943 represents an addition to a production in which a minimum of civilian goods is included.

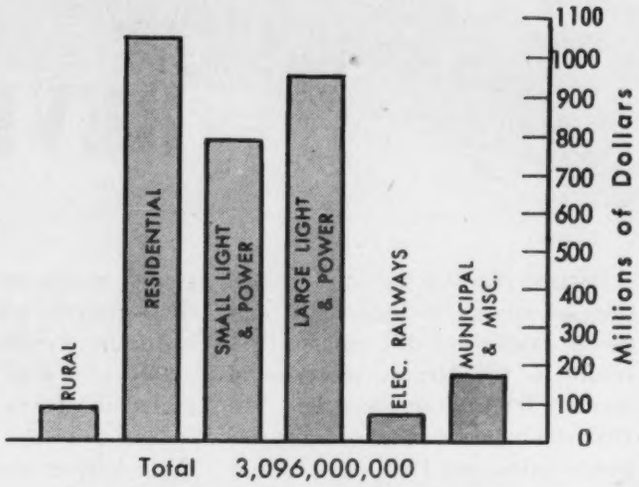
Hence the conclusion from the figures of energy sales that American industry hit its stride in war production in 1943. The initial period of displacement of civilian production ended with 1942. Corroboratory evidence appears in the figures of changes in number of commercial and industrial customers in 1942 and 1943. In 1942 there were 103,000 fewer of these customers than in 1941; in 1943 the decrease was only 84,000. These customer figures show that the rate of displacement of civilian production is markedly slower than it was. Perhaps—probably, from indications now apparent—civilian production reached its low point in 1943 and the energy sales figures for 1944 will justify such comment in ELECTRICAL WORLD's 41st annual statistical number next year.

It is to be noted from the general direction of the curve of growth of the large light and power load in





Energy Sales by Classes of Consumers, 1943



Revenue by Classes of Consumers, 1943

the '20's that the high point now reached in this year of war is not very far away from the point the curve might have been expected to reach if the depression of the '30's and the war had not supervened. In other words, the large light and power use of electricity is now about where it would have been if the two cataclysms had not come upon us.

It is interesting to note that the ratio of usage by different classes of customers hasn't changed appreciably from normal. If we go back to 1930 we find large light and power sales around four times residential. In 1943 they were just a shade under four times.

The increase in sale of energy to residential customers in 1943 over 1942 is almost exactly the same as in 1942 over 1941. About 600,000 more customers in 1943 account for some of this increase of 1.8 billions of kw.-hrs. and some of it shows up in the increase of 61 kw.-hr. in average annual consumption, 1012 kw.-hr. in 1942 and 1073 in 1943 (see page 105). This large increase in home use of electricity, more strikingly apparent in the average increase per customer of 61 kw.-hr. in 1943, second only to the big rise of 78 kw.-hr. in 1937, occurring at a time when new appliances were practically unobtainable, says without equivocation that the effort to keep up home electric appliances in service is getting results.

The very slight decrease in sales of energy to rural customers shown in the table is not to be taken as positive evidence that these customers are using less electricity. The 1943 figure is an estimate, like all the others for the year; it may be somewhat off the mark.

In spite of the fact that the mortality among commercial and industrial customers continued in 1943 with devastating effect on numbers of users in the small light and power group the amount of energy used by these customers rose considerably in 1943, about 1.9 billion kw.-hr. In 1942 the increase was 2.6 billion, the highest shown in the 14-year record included in the table. In this condition of fewer and fewer customers using more and more electricity is evidence of increased participation of smaller industrials in war production.

Energy Sales to Ultimate Consumers

(In Millions of Kw.-Hr.)

Year	Rural	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total to Ultimate Consumers
1930...	1,789	10,703	13,944	40,148	2,227	4,996	591	508	74,906
1931...	1,879	11,373	13,544	36,937	2,330	4,549	626	664	71,902
1932...	1,579	11,494	12,106	30,965	2,033	4,040	568	926	63,711
1933...	1,633	11,358	11,589	33,857	1,893	3,991	668	927	65,916
1934...	1,858	12,233	12,278	36,943	1,896	4,237	692	945	71,082
1935...	1,693	13,496	13,588	40,864	2,078	4,194	841	842	77,596
1936...	2,138	14,992	15,612	48,655	2,223	4,401	1,115	908	90,044
1937†..	1,670	17,691	18,075	51,360	1,863	4,428	1,284	2,987	99,359
1938...	1,577	19,371	19,137	43,140	1,929	3,989	1,449	3,138	93,731
1939...	1,881	21,084	20,722	51,108	2,002	3,918	1,847	3,205	105,768
1940...	1,991	23,318	22,373	59,557	2,048	3,974	1,935	3,447	118,643
1941...	2,352	25,124	24,628	76,060	2,111	3,960	2,118	3,707	140,060
1942...	2,890	26,937	27,234	88,378	2,061	4,256	2,372	5,280	159,408
1943*..	2,875	28,775	29,100	106,050	2,150	4,675	2,575	9,800	186,000

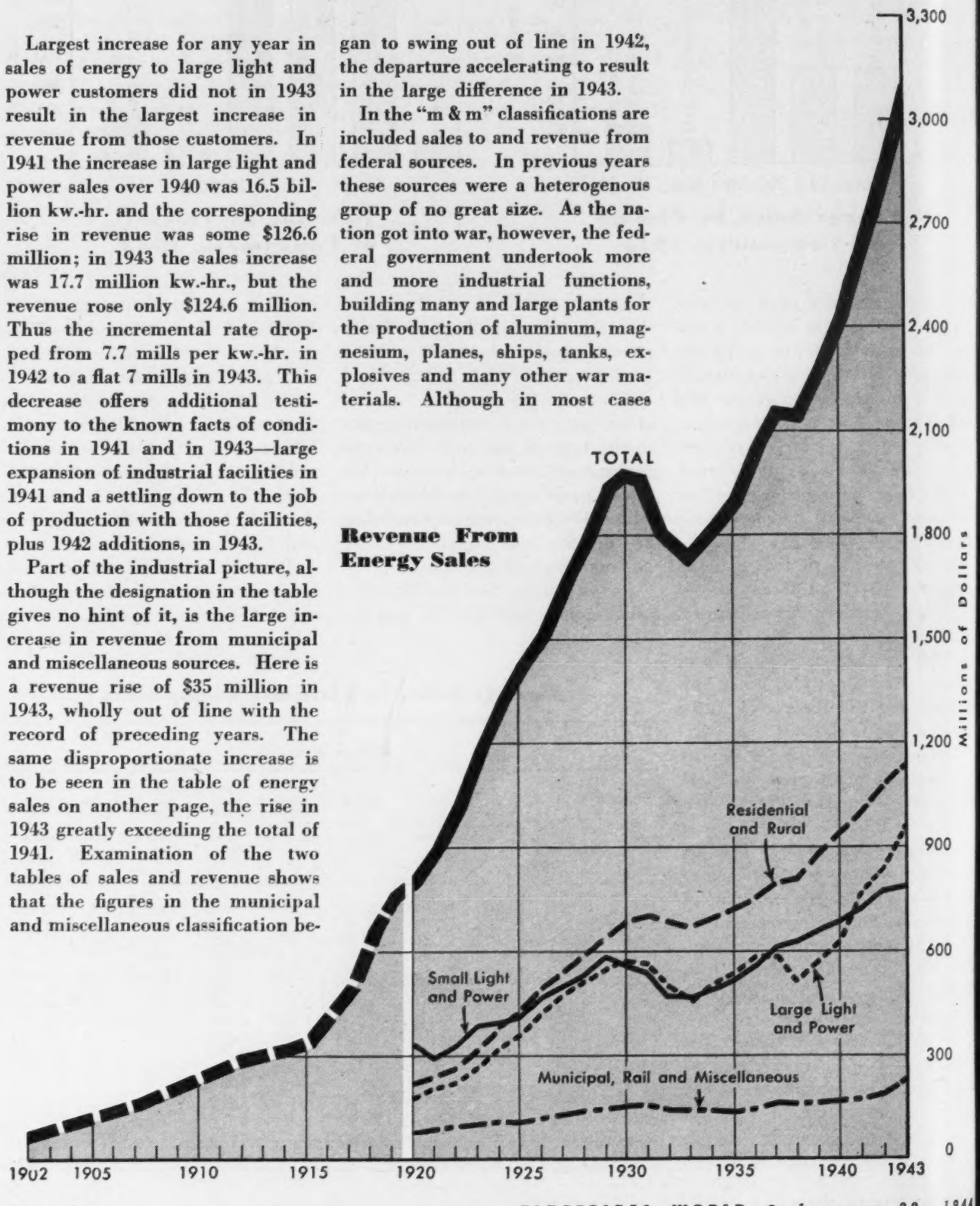
Source: Edison Electric Institute. * Estimated. † Revised figures to conform with Uniform System of Accounts prescribed by Federal Power Commission from 1937.

$3,096,000,000 REVENUE

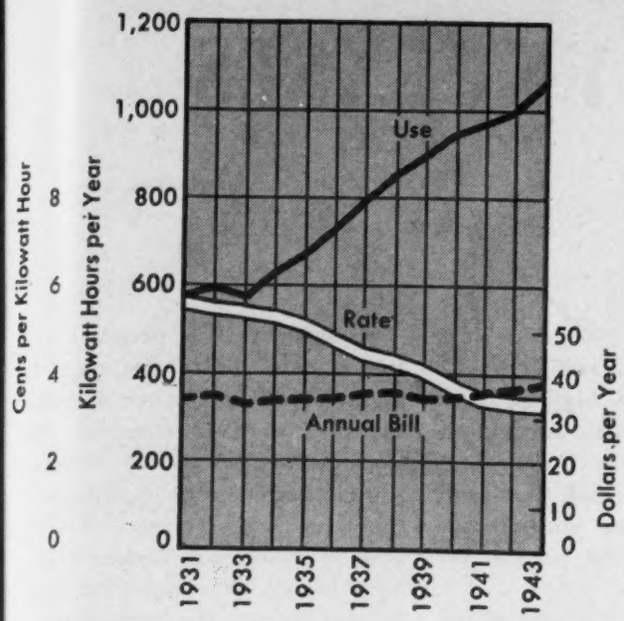
Largest increase for any year in sales of energy to large light and power customers did not in 1943 result in the largest increase in revenue from those customers. In 1941 the increase in large light and power sales over 1940 was 16.5 billion kw.-hr. and the corresponding rise in revenue was some $126.6 million; in 1943 the sales increase was 17.7 million kw.-hr., but the revenue rose only $124.6 million. Thus the incremental rate dropped from 7.7 mills per kw.-hr. in 1942 to a flat 7 mills in 1943. This decrease offers additional testimony to the known facts of conditions in 1941 and in 1943—large expansion of industrial facilities in 1941 and a settling down to the job of production with those facilities, plus 1942 additions, in 1943.

Part of the industrial picture, although the designation in the table gives no hint of it, is the large increase in revenue from municipal and miscellaneous sources. Here is a revenue rise of $35 million in 1943, wholly out of line with the record of preceding years. The same disproportionate increase is to be seen in the table of energy sales on another page, the rise in 1943 greatly exceeding the total of 1941. Examination of the two tables of sales and revenue shows that the figures in the municipal and miscellaneous classification began to swing out of line in 1942, the departure accelerating to result in the large difference in 1943.

In the "m & m" classifications are included sales to and revenue from federal sources. In previous years these sources were a heterogenous group of no great size. As the nation got into war, however, the federal government undertook more and more industrial functions, building many and large plants for the production of aluminum, magnesium, planes, ships, tanks, explosives and many other war materials. Although in most cases



Averages for Residential Service



Residential Service to Urban and Non-Farm Homes

Year	Kw.-Hr. per Customer	Average Annual Bill (Dollars)	Revenue per Kw.-Hr. (Cents)
1931....	578	33.18	5.74
1932....	597	33.25	5.57
1933....	600	33.12	5.52
1934....	624	33.07	5.30
1935....	672	33.53	4.99
1936....	727	33.81	4.65
1937....	805	34.62	4.30
1938....	853	35.31	4.14
1939....	897	35.88	4.00
1940....	952	36.56	3.84
1941....	986	36.78	3.73
1942....	1,012	37.51	3.67
1943*....	1,073	39.06	3.64

Source: Edison Electric Institute. *Estimated

these plants are run by companies established in the various lines of production, title to them remains in the Defense Plant Corporation and their operations are handled as activities of government. Thus in the past two years there have been added to the "m&m" classifications large accretions of sales and revenue that properly belong, for the statistical record, in the column of large light and power. One might say, from examination of the figures of previous years, that to correct this record error well over $50 million and 6 billion kw.-hr. should be added to the 1943 figures of revenue and energy sales for large light and power.

With the cost of living generally rising, the electric utilities still continue to give more for less to residential customers. The average revenue per kw.-hr. from these customers dropped to a new low of 3.64 cents in 1943. The conditions of war are slowing up the rate of decrease, as may be seen in the accompanying table, but the decrease does continue, and that is definitely a thing to be proud of when so many other living expenses are showing a marked upward trend.

Revenue from street railway load made another $3 million gain, reflecting gasoline rationing and heavier war worker traffic. Street and highway lighting energy sales were also up, largely as the result of canceling the dimout the first of November.

As indicated by the note appended to the table, revenue in the "Rural" column cannot be taken as entirely from farm customers. Therefore the figures in this column do not justify any conclusions about rural electrification.

Revenue From Electricity Sales

(In Thousands of Dollars)

Year	Rural‡	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total from Ultimate Consumers
1930	46,689	642,275	575,598	566,467	95,458	46,067	6,015	12,382	1,990,955
1931	50,726	653,282	564,523	544,728	99,298	41,912	6,725	14,746	1,975,944
1932	47,127	640,384	500,993	474,424	89,828	36,701	6,181	18,076	1,813,717
1933	46,501	623,797	471,780	468,389	83,097	35,098	6,658	19,243	1,754,366
1934	49,182	648,801	490,420	499,451	81,846	36,402	6,680	19,085	1,831,870
1935	48,404	673,526	519,213	531,106	79,429	36,431	7,944	15,933	1,911,988
1936	59,286	696,997	562,122	581,148	80,791	37,423	9,591	17,225	2,044,586
1937†	37,726	759,824	616,438	583,197	72,740	37,019	10,761	43,091	2,160,798
1938†	38,928	802,532	632,091	518,694	74,323	33,512	11,995	44,504	2,156,580
1939†	45,484	843,158	660,683	572,659	75,443	32,573	14,427	45,154	2,289,583
1940†	49,473	895,951	689,253	631,428	76,052	32,740	15,068	50,252	2,440,218
1941	64,396	938,229	725,117	758,083	76,949	32,471	16,474	53,338	2,665,057
1942	75,027	990,185	767,279	828,318	75,660	35,343	18,289	65,742	2,885,843
1943*	80,000	1,047,000	780,000	953,000	77,000	38,000	20,000	101,000	3,096,600

Source: Edison Electric Institute. * Estimated. † Uniform System of Accounts prescribed by Federal Power Commission begins new series of figures in 1937. ‡ Specific rural rates only.

Rising Faster than Revenue EXPENSES

Operating revenue up 7.9 percent, operating expenditures up 12.1 and taxes up 12.7 add up to operating ratios of 40.3 percent before and 65.5 after taxes as the measure of electric utility performance in 1943.

Although the utilities produced 17 percent more energy in 1943 than in 1942, they had $16 million less in 1943 left from operating revenue for debt service, surplus and equity return after expenses, taxes and depreciation were taken out.

According to estimate possible at the end of the year utility taxes rose $80 million in 1943, as against $110 million in 1942 and $116 million in 1941. The big rise that caused 1943 operating income to drop below 1942 was in operating expenditures, in which fuel and salaries and wages showed increases of 1.4 and 0.8 percent respectively.

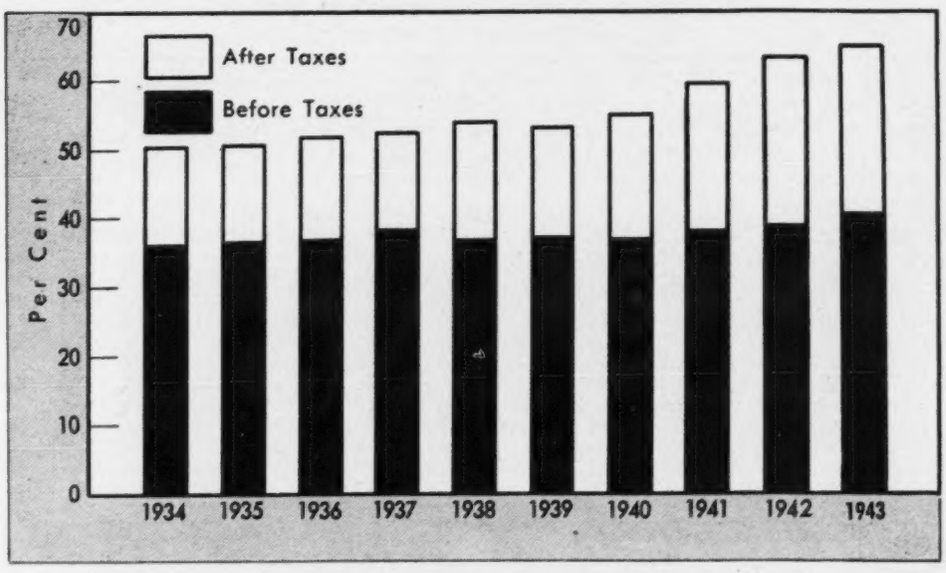
But even though the rate of tax increase shows deceleration in 1943, the increase is great enough so that now taxes take 25.2 cents out of every dollar the consumer pays for electric service, one cent more than the 24.2 cents for fuel and salaries and wages combined.

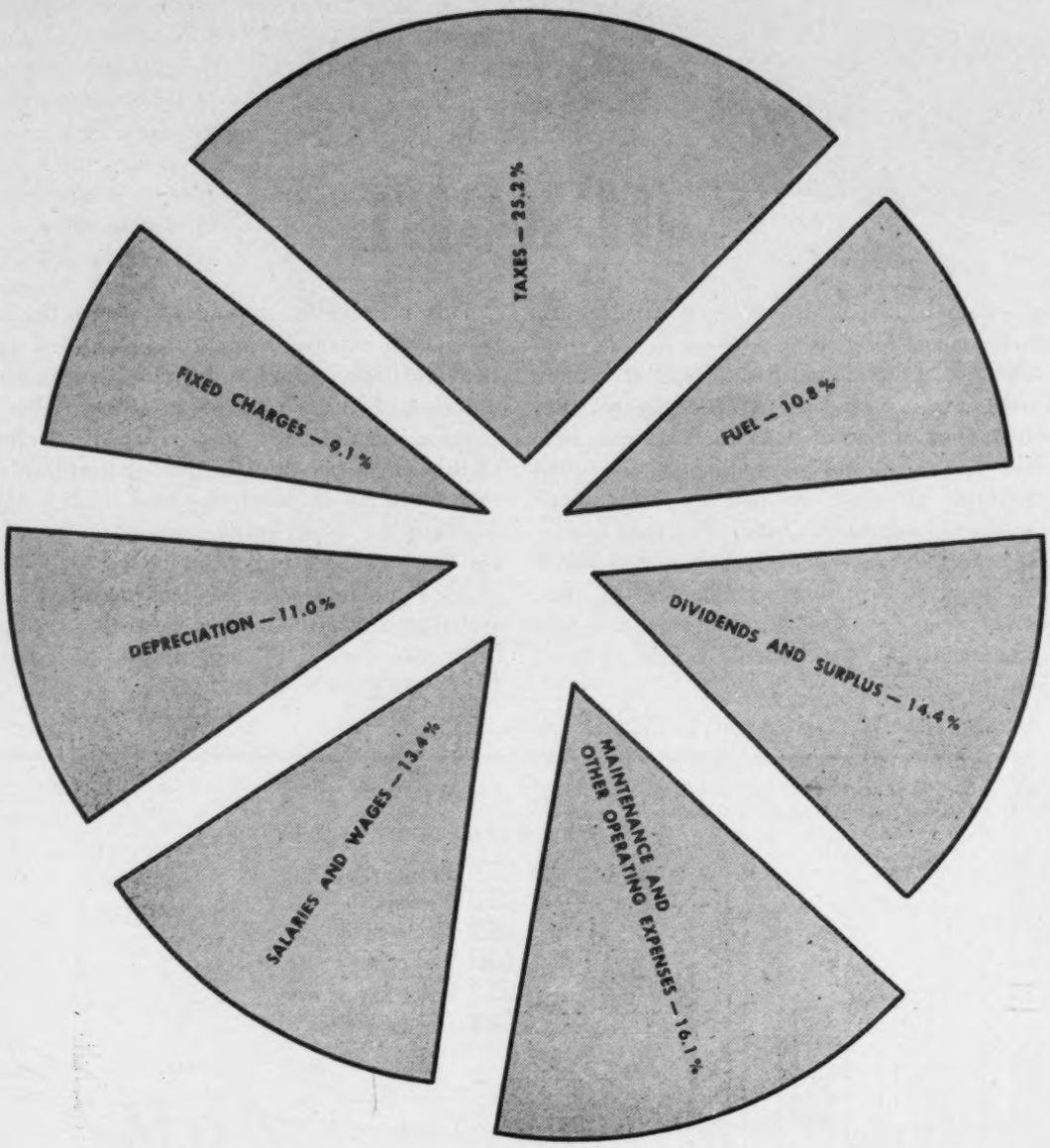
Slightly smaller proportion of the revenue dollar was spent for maintenance and other operating expenses in 1943 than in 1942. Considering the greatly increased production per unit of capacity in the later year, it seems that this item of maintenance should have been larger. But need for maintenance is not the only determinant of maintenance work. There is also the ability to obtain labor and materials for it, both in rather short supply in 1943. Probably this item will show a considerable increase when war scarcities recede into history.

Operating Ratio Before and After Taxes

Electric Utility Companies

	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
Before Taxes..	36.6	36.9	37.3	38.5	37.3	37.4	37.5	38.4	38.7	40.3
After Taxes...	50.6	50.9	52.2	53.8	54.2	53.3	55.3	59.4	62.9	65.5




TAXES — 25.2%
FUEL — 10.8%
DIVIDENDS AND SURPLUS — 14.4%
MAINTENANCE AND OTHER OPERATING EXPENSES — 16.1%
SALARIES AND WAGES — 13.4%
DEPRECIATION — 11.0%
FIXED CHARGES — 9.1%

Allocation of Electricity Sales Revenue Dollar, 1943

Direct comparisons between the 1942 and 1943 proportions of fixed charges and of dividends and surplus are not permissible because of a correction in the present chart. Previously the figures had represented combined operations of electric utilities, some of which are not electric at all, for instance, gas, ice, water and transportation services. These services had been included in the items of fixed charges and of dividends and surplus. This year they are excluded and the proportions of these elements in the chart thus are changed more than by just the changes in conditions during the year. The effect of the correction is to make dividends and surplus slightly larger than last year and fixed charges definitely smaller. Refunding operations, increasing about 37 percent from $264 million in 1942 to $361 million in 1943, also has had their effect in reducing the fixed charges.

The data presented here are estimates based on operations of the first nine months of 1943 and are subject to revision when the record for the year is complete. And considering the times, the revision may be significant. Conditions during a war do not furnish the solidest kind of bases for estimates.

Operating Revenue, Expenditures, Taxes

Privately Owned Establishments*
(In Millions of Dollars)

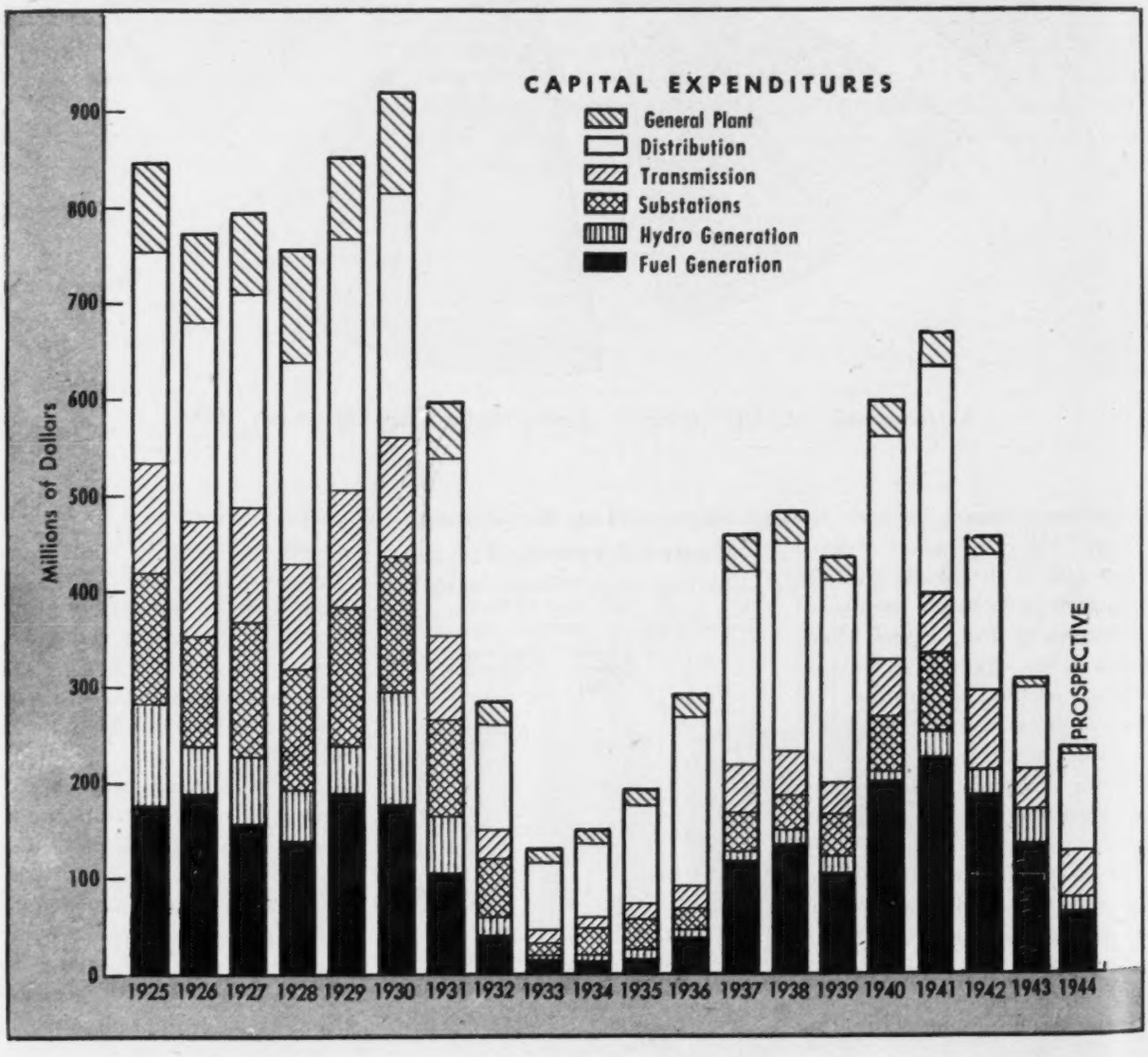
Year	Operating Revenue	Operating Expenditures	Taxes
1934.....	1,710	635	239
1935.....	1,785	669	251
1936.....	1,911	721	281
1937.....	2,031	781	308
1938.....	2,018	762	323
1939.....	2,148	798	352
1940.....	2,277	863	404
1941.....	2,467	947	520
1942.....	2,611	1,011	630
1943†.....	2,816	1,134	710‡

Source: Edison Electric Institute.
* Date adjusted to cover only utilities operating as private enterprises on December 31, 1941.
† Subject to year-end revisions.
‡ Estimate based on provisions of House Bill 3687

$370,000,000 BUDGET

Proposed expenditures by the electric utilities for new construction in the coming year are a reflection of war conditions. Looking at the amount of money disbursed for new construction in 1943 in relation to the performance of the utilities in that year, it is evident that the proposed expenditures for 1944 amply guarantee as good or better performance under the now established war load. The load is now well past its period of rapid growth; it is pretty much settled down to a known burden. Considering this, the 23 percent drop from 1943 actual to 1944 proposed expenditures could be much larger without arousing any fears.

This conclusion is pointed up by the long drops from 1943 expenditures to the proposed amounts for 1944 additions to fuel and hydro plant capacity. These reduced additions to capacity, shown also in the discussion and data of "New Capacity" on earlier pages of this issue, say that the job of building up production facilities to meet the war load is slacking off. Attention is now being turned to improvement of facilities for getting production to points of use. There is no indication of slacking off in transmission and distribution. On the contrary, expenditures in these two classes of construction will be higher in 1944 than they were in 1943.



In an attempt to establish a basis for estimate of the electric utilities' expenditures in the event of the expected defeat of Germany, contributors of data were asked to say what their expenditures in 1944 might be if that defeat occurred during the first six months of the year. The bottom third of the vertical tabulation shows the results of this inquiry. Replies varied from no to quite large increases.

In national terms it appears that if Germany is defeated in the first half of 1944 electric utility total capital expenditures in the year will increase about 17 percent. Such increase, if it comes, will occur in the second half of the year. Thus the rate of total expenditure will accelerate by a third or more in that six-month period. Distribution expenditure will increase faster, about a 50-percent acceleration.

Of the 155 replies that reported 1944 proposed expenditures for fuel-power plants, 109 said the defeat of Germany would not change their plans for this construction. Increases in fuel-power plant expenditures would be made by 45. Only one would reduce its program. Proposed expenditures in 1944 for fuel-power construction amount to $66 million. If German defeat occurs in the first half of the year, these expenditures will go to $78 million, an increase of about 18 percent, indicating an acceleration of around 36 percent in this construction in the second six months of 1944.

Expanding the figures presented here, which cover only power company and municipal utility operations, to include federal and other government projects, the total budget for 1944 will rise to around $370 million.

Capital Expenditures, 1943

As Reported to "Electrical World" (In Thousands of Dollars)

Region	Fuel Stations	Hydro Stations	Transmission Plant	Distribution Plant	General Plant	Total Plant	Substations*
N.E	9,605,146	491,769	1,174,783	5,065,608	511,719	16,849,025	1,385,817
M.A.	17,020,604	347,772	8,145,343	19,200,185	1,112,988	45,826,892	9,609,191
E.N.C.	36,155,610	155,772	11,744,025	20,451,420	2,532,437	71,039,264	2,420,573
W.N.C.	11,999,260	109,272	2,758,602	6,179,874	531,662	21,578,670	159,300
S.A.	24,871,059	133,792	3,000,417	10,884,638	237,994	39,127,900	4,182,334
E.S.C.	4,251,851	119,850	786,888	202,394	178,923	5,539,906	966,186
W.S.C.	15,196,122	135	2,900,110	4,503,025	242,143	22,841,535	1,526,421
Mountain	634,736	199,333	2,253,724	1,872,141	175,326	5,135,260	3,677,160
Pacific	17,324,945	33,947,654	10,209,042	16,323,723	542,380	78,347,744	8,813,052
Totals	137,059,333	35,505,349	42,972,934	84,683,008	6,065,572	306,286,196	32,740,034

Prospective Capital Expenditures, 1944

N.E.	2,067,520	533,728	1,146,390	6,197,937	514,259	10,459,834	1,566,642
M.A.	10,674,427	219,271	7,094,658	20,551,378	2,837,760	41,377,494	5,997,706
E.N.C.	25,102,153	465,119	16,523,685	23,602,216	3,063,922	68,757,095	10,382,574
W.N.C.	4,757,926	489,056	3,548,852	7,216,573	649,022	16,661,429	2,230,502
S.A.	14,554,350	683,102	6,744,569	11,209,678	383,179	33,574,878	4,100,330
E.S.C.	2,245,103	17,469	1,432,352	2,083,354	218,829	5,997,107	907,088
W.N.C.	3,650,468	6,547	3,717,350	6,809,501	379,488	14,563,354	2,164,360
Mountain	490,250	402,270	650,132	1,668,740	96,768	3,308,160	499,561
Pacific	2,331,485	10,072,360	9,225,388	17,232,636	409,114	39,270,983	8,192,642
Totals	65,873,683	12,888,922	50,083,376	96,572,013	4,552,341	233,970,334	35,991,405

Possible Capital Expenditures, 1944

N.E.	3,440,424	741,520	1,466,148	9,752,170	896,124	16,296,386	2,374,617
M.A.	12,896,320	216,595	7,558,133	22,821,626	2,934,520	46,427,194	6,948,035
E.N.C.	29,873,994	571,119	17,245,099	27,015,402	4,429,175	79,134,789	18,782,097
W.N.C.	5,625,472	499,496	4,768,734	8,171,165	762,593	19,827,460	2,664,244
S.A.	14,574,238	708,753	7,215,954	13,094,422	507,763	36,101,130	5,600,931
E.S.C.	2,276,603	17,467	1,502,392	2,517,654	242,060	6,556,176	955,125
W.S.C.	3,736,530	6,548	3,948,165	8,313,625	571,688	16,576,556	1,955,313
Mountain	702,250	359,340	924,587	2,785,028	662,148	5,433,353	776,898
Pacific	4,628,285	11,068,633	9,393,983	23,633,104	414,526	49,138,531	9,642,290
Total U.S.	77,754,116	14,189,471	54,023,195	118,104,196	11,420,597	275,491,575	49,699,550

*Substation expenditures are included in those for transmission and distribution plant.
†"Possible Capital Expenditures, 1944," are those that may be made if defeat of Germany occurs in the first half of 1944.

Annual Capital Expenditures for New Construction

Electric Light and Power Industry (In Thousands of Dollars)

Year	Fuel	Hydro	Transmission	Substations*	Distribution	General Plant	Total
1929	188,000	51,000	145,000	120,000	261,000	88,000	853,000
1930	176,496	117,565	139,533	123,482	258,699	103,642	919,417
1931	104,386	60,317	101,031	87,564	182,158	61,284	596,740
1932	40,000	20,000	60,000	30,000	110,000	25,000	285,000
1933	10,400	4,000	16,100	14,900	72,200	11,700	129,300
1934	10,258	5,704	30,180	11,921	76,299	13,292	147,654
1935	16,172	6,337	35,349	14,766	103,104	17,127	192,855
1936	36,820	9,030	20,170	25,050	174,640	24,000	289,710
1937	113,060	10,540	40,740	49,290	203,250	38,600	455,480
1938	133,000	17,600	36,000	46,400	215,000	34,000	482,000
1939	101,500	17,900	45,500	31,750	210,500	22,850	430,000
1940	200,430	9,270	55,900	57,760	237,700	35,520	596,580
1941	219,741	27,186	62,476	79,218	232,840	32,687	654,148
1942†	191,671	22,847	85,633	.....	144,180	11,644	455,975
1943	137,059	35,505	42,923	32,740	84,683	6,066	306,286
1944‡	65,874	12,889	50,083	35,991	96,572	8,552	233,970

*After 1941, substation expenditures, although separately stated, are included in figures for transmission and distribution.
†Expenditure study not made by "Electrical World" in 1942. Figures are those reported by Federal Power Commission for privately owned utilities only.
‡Prospective.

Very Little New Capital

FINANCIAL

New money coming into the electric utility business declined in 1943 to $9,921,000, a figure close to the lows of the depression years 1933 and 1934. New money in 1943 was only about a tenth of what it was in 1942. Now, more than ever, it is plainly apparent that the industry is financing itself; compare the expenditures for new construction shown on the two preceding pages with small figure for new money. Correspondingly the sales of common and preferred stocks also fell to a level comparable to those of the unlamented years. However, total financing increased somewhat in 1943, $371,062,000, as against $365,255,000 in 1942.

Refunding operations in 1943 increased in volume by nearly $100,000,000 over 1942, but remained far below the figures of 1941 and immediately preceding years.

Notable in the 1943 record are the decrease in securities sold to institutional investors, down to $26,850,000 from $99,688,000 in 1942, and the increase from $226,800,000 to $329,300,000 in bonds, debentures, etc., disposed of in public offerings. The rapid decline in offerings taken by institutional investors from the high of $255,912,000 in 1941 to the low of 1943 may be explained as a result of insistence by SEC on competitive bidding for bond issues.

Utilities entered the money market only 28 times in 1943, 19 times to sell bonds; once to sell debentures; three times, notes; four times, preferred stock; once, common stock. In 1942 there was a total of 39 offerings of the various kinds. Thus, with the total financing slightly higher in 1943, the average per operation was considerably larger than in 1942.

Yields on mortgage bonds sold in 1943 averaged 0.01 percent more than in 1942. Possibly this so small increase in average yield may be taken as significant, continuing as it does, although at considerably diminished rate, the trend of increase noted last year for 1942 over 1941. But over against that is the fact that average yield of preferred stocks sold in 1943 was 4.44 percent, as against 4.81 in 1942.

The record of financing in 1943 adds another affidavit to the pile of annual evidences testifying to the essential soundness of the utility industry, which has been able to meet and to handle the immense problem of war production so largely on its own resources.

New Utility Financing Totals $371,061,720

No. of Issues	Range of Yield	Amount of Issues
Mortgage Bonds (Av. yield 3.23%)		
4	2.50–2.80	$30,800,000
5	2.82–3.00	118,500,000
4	3.13–3.29	79,500,000
3	3.38–3.71	67,500,000
1	4.005	52,000,000
2	.....	3,100,000
19		$351,400,000
Debentures		
1	4	$1,000,000
Notes		
3	....	$3,750,000
Preferred Stock (Av. Yield 4.44%)		
2	3.83–5.13	$8,000,000
2	.....	3,803,200
4		$11,803,200
Common Stock		
1		3,108,720
Total Financing		$371,061,720
Refunding		361,140,720
New Capital		9,921,000

Security Sales by Classes

(In Thousands of Dollars)

Year	Bonds, Debentures, etc., to		Stocks, Common and Pfd.†	Total Financing†	Distribution of Security Sales*		
	Public Investors	Institutional Investors			New Capital	Refunding	Total Issues
1929.....	523,408		937,051	1,460,459	624,174	257,602	881,776
1930.....	1,114,636	Included	473,218	1,587,854	894,473	403,062	1,297,535
1931.....	1,090,584	in	417,658	1,508,242	424,163	758,741	1,182,904
1932.....	404,840	Col. 1	65,417	470,257	165,728	239,112	404,840
1933.....	53,725		2,523	56,248	6,813	46,913	53,725
1934.....	131,175		.....	131,175	2,431	128,744	131,175
1935.....	957,042	110,629	8,229	1,075,900	26,496	1,049,404	1,075,900
1936.....	1,122,800	156,881	52,259	1,331,940	59,727	1,272,213	1,331,940
1937.....	522,613	37,604	86,095	646,312	81,984	563,699	645,682
1938.....	750,549	192,762	20,694	964,005	123,056	840,949	964,005
1939.....	620,205	252,625	123,517	996,347	16,219	980,128	996,347
1940.....	660,716	188,976	139,767	989,459	92,376	897,083	989,459
1941.....	368,712	255,912	116,208	740,832	97,065	643,767	740,832
1942.....	226,800	94,988	29,766	351,554	92,466	259,088	351,554
1942.....	226,800	99,688	29,766	356,254	92,666	263,588	356,254
1943.....	329,300	26,850	14,912	371,062	9,921	361,141	371,062

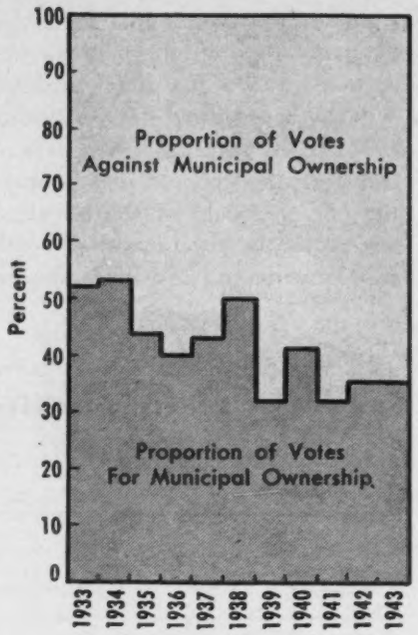
MUNICIPAL OWNERSHIP TREND

Indication of a growing popular disposition to look with lessened favor on government ownership and operation of electric utilities appears in the data on this page. The figures were compiled by the Edison Electric Institute on information coming from various sources, newspaper clipping service the most important. Naturally, the data are not claimed to be inclusive; by the manner of their collection they could not hope to be. Yet a report on 1,052 elections, pretty evenly distributed in number over a period of eleven years, should have more than just a little validity. In fact, in the absence of equally or more comprehensive quantitative information to the contrary, this report cannot be questioned at all.

The tabulation presents the figures in two aspects, by elections and by population weights. In the eleven-year period 503 elections went in favor of government ownership and 549 against. More than half of the elections, 549 of them, occurred in the first five years of the New Deal, and only 292 of them, or little more than half, went for M.O. or rejected franchises to power companies. And these were the lush years of the 45-percent PWA handouts. The sixth was the last year of PWA largesse and strenuous efforts were made to coax passengers aboard the gravy train. The result appears in the 218 elections held that year, and of these M.O. did not win as many as, considering the circumstances, might have been expected. In the five remaining years of the period, 285 elections were held and 184 of them, about 64 percent, favored the power companies. As significant as the comparison of elections won and lost is the decline in their numbers in the last five years of the period, 285, as against 767 in the previous six.

In the right-hand half of the tabulation the results appear weighted by populations affected. For instance, in 1933 the 78 municipalities that voted in favor of M.O. had a total population of 4,595,096, while those that voted against had a total population of 1,924,509. While the percentages of populations for M.O. depart in some cases quite widely from the corresponding percentages of elections for M.O., both percentage columns show the same trend of lessening enthusiasm for government ownership.

The decline of M.O. in popular favor appears graphically in the percentage area chart of votes cast.



This chart is admittedly defective in that it represents only those elections whose reports contained number of votes cast, not all of the reports by any means. In many cases the information was only that the one or the other side won by a close vote or by two to one or whatever the ratio might be. However, and again in default of quantitative evidence, this chart does show quite definitely the progressive change in the temper of the voting citizen through the eleven-year period.

Results of Municipal Plant and Franchise Elections, 1933-1943

	Number of Elections Held				Results Weighted by Population				
	For M.O.		Against M.O.	Totals		For M.O.		Against M.O.	Totals
1933	78	70.3%	33	111	1933	4,595,096	70.5%	1,924,509	6,519,605
1934	58	55.3	47	105	1934	3,904,134	63.3	2,251,362	6,155,496
1935	65	59.1	45	110	1935	718,548	54.9	591,234	1,309,782
1936	49	38.6	78	127	1936	1,572,697	27.4	4,162,188	5,734,885
1937	42	43.8	54	96	1937	333,952	11.4	2,605,458	2,939,410
1938	110	50.5	108	218	1938	538,754	37.2	907,717	1,446,471
1939	36	43.4	47	83	1939	122,984	11.9	912,945	1,035,929
1940	28	26.2	76	104	1940	257,818	17.3	1,233,895	1,491,713
1941	26	42.6	35	61	1941	55,122	3.5	1,518,985	1,574,107
1942	8	32.0	17	25	1942	29,362	13.4	188,723	218,085
1943*	3	25.0	9	12	1943*	68,355	18.1	307,836	376,191

*Up to December 2. Includes Imperial Irrigation District acquisition started some years ago.

DIVESTMENTS

Some 70 changes in ownership of electric utility properties, complete systems or parts of systems, appear in the list here presented. In ELECTRICAL WORLD'S preceding statistical number (January 23, 1943) there were published data on 105 sales or other transfers of electric utility properties occurring since the effective date of the so-called holding company act, passed by the Congress in 1935. The present list supplements and continues the previous one, adding some transactions not then reported that took pla before or during 1942 as well as reporting tho occurring in 1943 up to November 15.

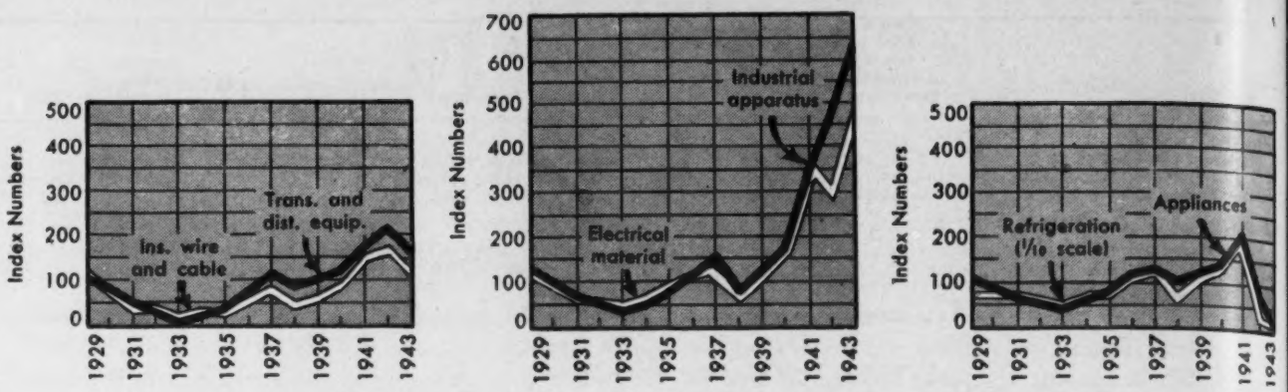
Of the transactions listed here, 36 are transfers property to other utilities or holding companies to individuals and three are dissolutions or merger The remaining 32 are divided in sales to co-operative 8, and to public utility districts, municipalities an other government bodies, 24.

Electric Utility Properties Divested or Sold by Registered Holding Companies

Supplemental and Continuing List to November 15, 1943

System Company	Total Assets of Divested Subsidiary	Details of Divestment	Consideration If Sold	Date
American Power & Light Co.				
Florida Power & Light Co.		Sale of electric properties at Tavernier, Fla., to Florida Keys Electric Co-op. Ass'n., Inc.	6,230	1942
Northwestern Electric Co.		Sale of distribution system serving North Bonneville, Washington, to Skamania County P.U.D. No. 1	68,000	1942
Pacific Power & Light Co.		Sale of distribution system in Skamania County, Washington, to Skamania County P.U.D. No. 1	32,000	1942
Texas Electric Service Co.		Sale of distribution system in Grand Falls, Tex., to Red Bluff Water Power Control District	15,887	1942
		Sale of electric utility property at Eagle Pass, Tex., to Central Power & Light Co.	350,000	Oct. 19
American States Utilities Corp.				
Hermiston Light and Power Co.	$168,466	Sale of note and common stock to International Utilities Corp. and Ralph Elsman, Liquidating Trustee	110,000	July 19
American Utilities Service Corp.				
Louisiana Public Service Corp.		Sale of remaining assets to Louisiana Power & Light Co.	437,156	July 19
Minnesota Utilities Co.		Sale of electric utility assets in Gray Eagle District to Minnesota Power & Light Co.	88,469	July 19
		Sale of electric utility assets in Root River Division to Tri-County Electric Co-op. and Dairyland Power Co-op.	378,000	Nov. 19
		Sale of electric plant and distribution system in Pine River, Minnesota District, to Minnesota Power & Light Co.	200,000	Feb. 19
Northwestern Wisconsin Electric Co.	$776,068	Sale of all stock of company to a group of individuals	$264,365	April 19
Wisconsin Central Utilities Co.	471,269	Sale of electric utility assets in Galesville, Wis., to Mississippi Valley Public Service Co.	67,767	June 19
		Sale of assets in LaFarge and Viola, Wis., to the respective villages	87,157	Mar. 19
American Water Works and Electri Co., Inc.				
West Penn Power Co.		Sale of distribution plant to Borough of Tarentum, Pa.	2,070	19
		Sale of distribution plant to Western Penitentiary, Bellefonte, Pa.	6,902	19
Associated Gas & Electric Corp.				
Eastern Shore Public Service Co.	17,788,943	All common stock plus $6,071,000 in cash given to United Gas Improvement Co. in exchange for stock of Erie County Electric Co.		Aug. 19
General Utilities Co.	1,138,517	Sale of all assets of the three companies to city of Lodi, Ohio, and eight rural electric co-ops.	1,100,000	Dec. 19
New London Power Co.	120,193			
Western Reserve Power & Light Co.	698,894			
Litchfield Electric Light & Power Co.	$1,208,716	Sale of common stock to Connecticut Light & Power Co.	$485,000	Sept. 19
Louisiana Public Utilities Co., Inc	6,621,448	Sale of all securities and claims against the company to group of individuals	3,000,000	Dec. 19
New York State Electric & Gas Corp.		Sale of distribution facilities in Plattsburg to city of Plattsburg, New York	180,000	April 19
Ohio Northern Public Service Co.	587,588	Sale of entire interest in company to city of Bowling Green, Ky.	549,000	Nov. 19
Panhandle Public Service Co.	329,828	Sale of electric and ice properties to Northwestern Electric Co-op., Inc.	175,000	July 19
Tri-City Utilities Co.		Sale of Ohio River electric distribution system to Green River Electric Co-op. Corp. and Meade County Electric Co-op. Corp. of Kentucky	198,922	Dec. 19
		Sale of Frankfort electric and water system to city	1,200,000	Aug. 19
		Sale of electric properties in Jellico, Tenn., to city	60,000	Aug. 19
Central New Hampshire Power Co.	1,888,171	All assets transferred to bondholders and noteholders and holding company dissolved		Aug. 19
Central States Edison, Inc.				
Blue Valley Electric Co.		Sale of electric distribution system at Steele City, Neb., to city of Fairbury	7,705	June 19
Gasconade Power Co.		Sale of electric distribution system at Owensville, Mo., to city	36,000	July 19
North Kansas Power and Light Co.	50,451	Sale of physical properties to city of Alma, Kan.	24,000	Jan. 19

System Company	Total Assets of Divested Subsidiary	Details of Divestment	Consideration If Sold	Date
Cities Service Co.				
Citizens Electric Co.	2,147,085	Sale of all securities of company to Gus B. Walton	1,533,000	July 1943
Public Service Co. of Colorado	104,764,752	Sale of all outstanding common stock to the public	20,453,125	Nov. 1943
New Brunswick Power Co.	7,915,911	Sale of investment to United Service Corp., Ltd.	N.A.	April 1943
Commonwealth & Southern Corp.				
Alabama Power Co.		Sale of properties in eleven Alabama Counties to TVA and other public groups	4,268,848	1940
Mississippi Power Co.		Sale of properties in northern Mississippi to TVA	2,022,000	1939
Crescent Public Service Co.				
Carey Electric Co.	157,589	Sale of all outstanding securities to G.M. Dunne and D.E. Dunne	80,500	May 1942
Electric Power & Light Corp.				
Idaho Power Co.	50,123,896	Sale of all common stock to the public	10,361,000	Aug. 1943
Engineers Public Service Co.				
Key West Electric Co.	$1,255,592	Sale of all stock to city of Key West, Fla.	$660,000	April 1943
Northern Kansas Power Co.		Sale of Woodruff, Kan., properties to an electric co-op. corporation	2,500	Aug. 1943
Pudget Sound Power & Light Co.	130,217,950	Old common and preferred stock of Puget exchanged for new common leaving Engineers with less than a controlling interest in the company		April 1943
Western Public Service Co. (Del.)		Sale of Burus, Hawk Springs, Huntley and LeGrange, Wyo., properties to town of Burus and an electric co-op. corporation.	55,044	1942–1943
International Hydro-Electric System (Trustees)				
Oconto River Power Co.	68,703	Sale of all properties to Wisconsin-Michigan Power Co.	90,000	Nov. 1939
Middle West Corp.				
Kansas Electric Power Co.	14,305,384	Sale of all common stock to Kansas Power & Light Co.	2,500,000	Aug. 1943
Kentucky Utilities Co.		Transfer of certain properties and cash for properties of Tri-City Utilities Co.		Dec. 1942
Missouri Public Service Corp.	9,429,328	Sale of Middle West holdings of approximately 31% of the common stock to Ralph J. Green	279,352	June 1940
Public Service Co. of Oklahoma		Sale of certain Texas properties to Northwestern Electric Co-op.	175,000	Sept. 1943
Midland United Co.				
Public Service Co. of Indiana, Inc.		Sale of distribution system in Lebanon, Ind., to city	352,000	Oct. 1943
Montana Dakota Utilities Co.	34,074,865	Merged with two of its operating subsidiaries, Montana-Dakota Power Co. and Montana Cities Gas Co.		1936
National Power & Light Co.				
Holston River Electric Co.	280,147	Sale of all electric properties to TVA	87,500	Sept. 1938
Houston Lighting & Power Co.	67,116,400	Common held by National was partially exchanged for National's preferred stock and the balance sold to the public	12,582,128	May 1943
Mauch Chunk Heat, Power & Electric Light Co.		Sale of National's investment in preferred and common stock to Mauch Chunk	30,000	April 1943
Nevada-California Electric Corp.	55,126,787	Merged with its electric utility subsidiaries		Dec. 1936
New England Public Service Co.				
Twin State Gas & Electric Co.		Sale of assets in town of Hoosick and Village of Hoosick Falls, N. Y., to New York Power & Light Corp.	207,899	April 1943
North American Co.				
Detroit Edison Co.	380,351,771	Common stock held by North American Co., representing 19% of the total outstanding, was distributed as dividends on North American Co. common stock		1941–1943
Des Moines Electric Light Co. Iowa Power & Light Co.	40,766,489	Sale by Illinois Iowa Power Co. of its investments in Des Moines and Iowa Power to Continental Gas & Electric Corp. and Iowa Power & Light Co.	15,220,000	Aug. 1943
North American Gas & Electric Co.				
Washington Gas & Electric Co.		Sale of Longview and Ryderwood, Wash., properties to Cowlitz Public Utility District	5,900,844	Nov. 1940
Northern States Power Co. (Del.)				
Northern States Power Co. (N.J.)	293,512	Sale of electric properties to South Dakota Public Service Co.	45,000	Sept. 1941
Ogden Corp. (Successor to Utilities Power & Light Corp.)				
Canada Electric Co., Ltd.	2,837,977	Sale of entire interest in companies to F. B. McCurdy	3,158,438	Sept. 1939
Eastern Electric & Development Co., Ltd.	280,697			
Moncton Electric & Gas Co., Ltd.	2,239,644			
Central Light & Power Co.	1,188,304	Sale of all securities to Otter Tail Power Co.	656,106	May 1941
Interstate Power Co. of North Dakota	169,745	Sale of all securities to Otter Tail Power Co.	125,000	July 1943
Peoples Light and Power Co.				
West Coast Power Co.		Sale of property in Clatskanie District to Clatskanie Public Utility District	150,000	1943
		Sale of Oregon Coast properties to Central Lincoln Public Utility District	735,000	1943
Western States Utilities Co.	938,392	Sale of Utah property to Utah Power & Light Co.	5,000	1941
		Sale of all common stock to Gerald L. Schlessman	142,500	Aug. 1943
Southwestern Public Service Co. (Successor to Community Power & Light Co.)				
Arkansas Utilities Co.	2,601,419	Sale of all outstanding securities to Gus B. Walton	1,725,000	Sept. 1943
Arizona Electric Power Co. Flatstaff Electric Light Co.	603,814 480,866	Sale of all outstanding securities to James C. Tucker	775,000	Mar. 1943
United Gas Improvement Co.				
Connecticut Railway & Lighting Co.	35,428,565	Sale of all equity securities held by U.G.I. to Charles U. Bay	1,815,000	Mar. 1943
Erie County Electric Co.	7,222,286	All stock given to Pennsylvania Electric Co. in exchange for securities of Eastern Shore Public Service Co. (Del.) plus cash		Aug. 1943
Philadelphia Electric Co. Public Service Corp. of N. J.	473,914,107 741,962,221	Securities of Philadelphia and Public Service held by U.G.I. were distributed to stockholders of U.G.I. as a partial liquidating dividend		Mar. 1943
United Illuminating Trust				
United Illuminating Co.	43,989,924	Exchange of United Illuminating Co. common stock for stock of Illuminating Shares Co.		1941

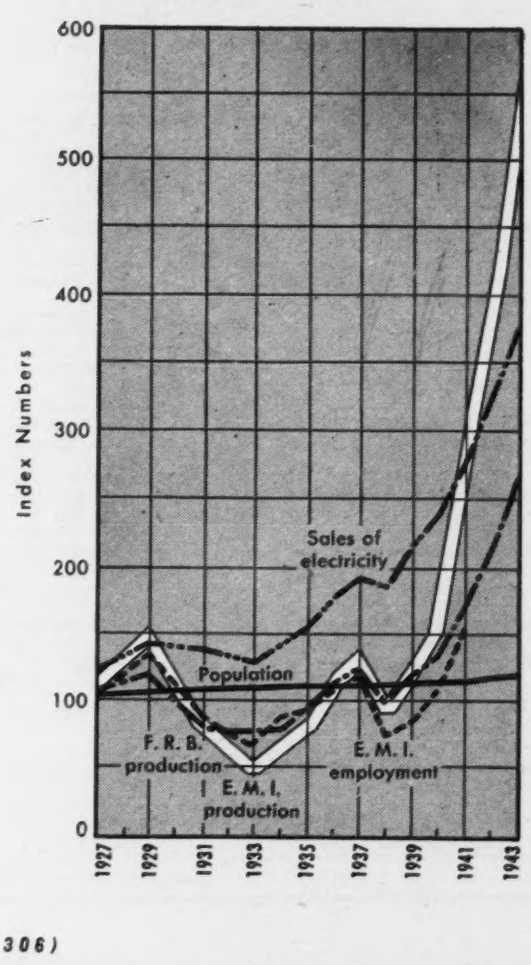


Manufacturers' Sales (Index: 1925 = 100)

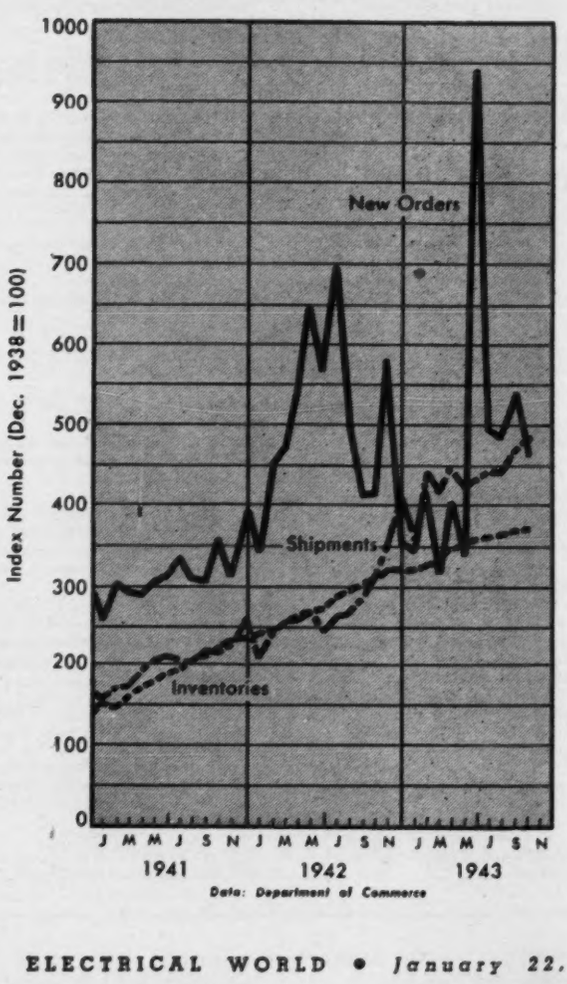
Settled Down to War Production

MANUFACTURING

Electrical Manufacturing and Related Factors



Electrical Machinery



Data: Department of Commerce

The Industry and Related Factors

Index Numbers 1925 = 100

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943*
1. E. M. I. production...	51	70	85	119	137	97	123	154	276	415	553
2. E. M. I. employment..	68	88	94	106	128	77	84	106	155	†	†
3. F. R. B. production...	76	82	96	113	124	97	120	137	178	219	267
4. Sales of electricity.....	131	141	155	180	199	187	212	238	281	319	373
5. Population.....	109	110	111	112	113	113	114	115	116	117	119
6. Electrical goods orders.	46	63	77	109	133	90	124	205	336	555	†

Source: N.E.M.A. * Estimated. † Not available.

1. E.M.I. PRODUCTION based on U. S. Census of Manufactures and data compiled by N.E.M.A. statistical department. In addition to products shown in electrical machinery apparatus and supplies schedule of the Census there are included electric refrigeration, radio apparatus and supplies, steam turbines for electrical drive, electrical porcelain, glass insulators and electric washing machines. Indices for the war years reflect production of non-electrical as well as electrical goods.

2. E.M.I. EMPLOYMENT based on labor series of National Industrial Conference Board, but adjusted to 1925=100. This series represents the electrical manufacturing industry including radio.

3. F.R.B. PRODUCTION based on the Federal Reserve Board's revised index for the manufacturing industry and adjusted to 1925=100. (Includes all revisions made by Federal Reserve Board up to Dec. 15, 1943.)

4. ELECTRIC POWER SALES index figures based upon Edison Electric Institute data.

5. POPULATION based upon the annual mid-year estimates of the U. S. Bureau of the Census.

6. NEW ORDERS booked — electrical goods — based on the quarterly reports of the U. S. Bureau of the Census.

The peak in war orders for electrical machinery has passed. Last year the new orders were 5 percent below those for 1942, in spite of the fact that June, with an index of 943, was well beyond the record of 700 hung up the previous July.

Production, on the other hand, in spite of previous big jumps, improved another 33 percent to an index figure of 553, and stood at more than ten times the level at the bottom of the depression. It is also interesting to see how much more the production of electrical manufacturers has increased than that of industry as a whole. It is double the figure of the Federal Reserve Board index of production.

This improved production is reflected in a steady rise in shipments during the year. In fact, 1943 shipments of electrical goods were more than 50 percent greater than those in 1942. To take care of this greater activity inventories increased by nearly 40 percent, with some indications, however, of leveling off during the last half of the year.

No specific data on backlog of orders are available. But it seems from the curves of new orders and shipments for electrical machinery shown on the opposite page that this new year opened with a smaller backlog than did the year before. Definite conclusion on this point is not justified by evidence now at hand except on the assumption that the figures on electrical machinery reflect the industry as a whole.

Some appliances were sold last year, but apparently the absolute bottom was reached. The big increase, of course, was in industrial apparatus, about 50 percent. Transmission and distribution equipment was off, reflecting the reduced construction of Army camps and war factories needing service. The same situation shows up in the production of insulated wire and cable.

Indications for 1944 are that production in non-war equipment will be increased substantially and that war production will fall off. It seems probable that the 1943 production will establish a record that will stand for some time.

Major Branches of Electrical Manufacturing Industry

Index Numbers 1925 = 100

	Manufacturers' Sales	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943*
1. Appliances.....	100 = $140,000,000...	57	73	92	121	136	109	128	151	212	73	9
2. Refrigeration.....	100 = 16,000,000.	574	747	844	1,131	1,360	769	1,100	1,331	1,800	264	156
3. Electrical material.....	100 = 38,000,000...	59	74	93	116	131	83	116	149	253	318	474
4. Industrial apparatus.....	100 = 132,000,000...	47	59	83	118	161	97	127	177	317	465	636
5. Trans. and dist. equip...	100 = 167,000,000...	22	33	50	83	124	90	104	124	189	213	167
6. Ins. wire and cable.....	100 = 110,000,000...	27	36	46	69	98	60	71	87	157	155	129

Source: N.E.M.A. * Estimated.

1. APPLIANCES include domestic kitchen and table appliances, electric ranges, electric water heaters, electric vacuum cleaners, electric washing machines, electric fans and food service equipment.

2. HOUSEHOLD REFRIGERATION includes complete units, parts and cabinets. Commercial refrigeration equipment and air conditioning equipment are excluded.

3. ELECTRICAL MATERIAL includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.

4. INDUSTRIAL APPARATUS includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding all generators except motor-generator sets). Electric furnaces and electric tools are excluded.

5. TRANSMISSION AND DISTRIBUTION EQUIPMENT includes switchgear, high-voltage insulators, power and distribution transformers, lightning arresters, pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers and watt-hour and demand meters.

6. INSULATED WIRE AND CABLE for light and power includes only the following types: weatherproof wire, paper-insulated power cable, varnished cambric cable, rubber-sheathed cord and cable and rubber-covered building wire.

All indices based upon U. S. Census of Manufacturers data and N.E.M.A. statistical department data corrected where possible to represent the entire industry.

War Limits Expansion of REA

For the first time it is possible to make comparison of REA systems operations by calendar years. Previously the data have been for a mixture of calendar and fiscal years.

Total energy input into REA systems last year exceeded 2 billion kilowatt-hours for the first time. Where in the two previous years 91 percent had been purchased, last year it was just a shade over 90 percent. The difference, though slight, does call attention to the fact that 14,500 kw. of capacity in seven more plants were added during the year and, while only 10 percent of the supply was co-op generated, the output of these plants, now 67 in all, increased by more than a third.

Purchased energy was greater by 40 percent and the cost was down to 8.5 mills from 9 mills in 1942 and 10 mills in 1941.

Energy losses, which were very high, are now dropping rapidly. In 1941 they were 22.7 percent; lower in 1942 to 20 percent, and last year a further reduction to 17.1 percent, an improvement in two years of nearly 25 percent.

Energy sales were up 40 percent last year to a total of 1.7 billion kw.-hr., but unfortunately the data are not broken down to show how much was sold to farms and how much to commercial and industrial loads, particularly those of a war nature, some of which were so large as to make comparisons worthless so far as disclosing the trend of farm usage. Reference is made to aluminum reduction, army camps, airfields and similar loads.

The effect of these loads is to be seen in several unit quantities derived from the tabulated data. Energy sold per customer increased from 803 kw.-hr. in 1941 to 1,137 in 1942 and to 1,546 in 1943. Obviously this almost doubling in two years did not result in any appreciable amount from increase of energy use on the average farm at a time when appliances and materials were particularly hard to obtain. The same conclusion is reached on the figures for average annual bill, $38.82, $46.36 and $51.27 in 1941, '42 and '43 respectively. Also, the decline in average revenue per kilowatt-hour from 4.84 cents in 1941 to 4.08 in 1942 to 3.32 in 1943 is quite too rapid to be ascribed to any other cause than the addition of large wholesale power loads.

Results of efforts to connect new users to existing lines appear in the number of customers per mile of line, 2.59 in 1941, 2.67 in 1942 and 2.78 in 1943.

The operating ratio reflected the large sales increase through a lower figure for last year. The three years 1941, 1942 and 1943 run 54.8, 57.3 and 56.7 percent respectively. This includes taxes, which, as will be noted in the data, amount to considerably less than 5 percent.

Statistics of REA-Financed Systems

(Prepared on the Basis of Reports Submitted by REA Borrowers)

Item	Calendar Year 1941	Calendar Year 1942	Calendar Year 1943*
Cumulative Year-End Data			
Total Funds Allotted	$433,988,321	$460,467,729	$472,000,000
Distribution Lines	$393,225,088	$406,342,296	$418,000,000
Generation and Transmission	$30,675,150	$43,365,850	$43,000,000
Consumer Facilities	$10,088,083	$10,759,583	$11,000,000
Funds Advanced	$332,033,107	$364,324,196	$377,800,000
Systems in Operation	773	803	810
Miles of Line in Operation	348,062	378,015	387,900
Consumers Connected	902,266	1,012,284	1,080,000
Systems Generating Power	48	60	67
Generating Plants—KW. Capacity	52,000	57,500	72,000
Annual Data			
Energy Generated—KW.-Hr	83,123,334	131,189,138	198,300,000
Energy Purchased—KW.-Hr	854,370,374	1,304,622,796	1,820,000,000
Total System Input	937,493,708	1,435,811,934	2,018,300,000
Energy Sold—KW.-Hr	724,384,550	1,150,535,928	1,672,700,000
Operating Revenues	$35,022,971	$46,927,322	$55,370,000
Cost of Purchased Energy	$8,583,200	$11,787,629	$15,400,000
Salaries and Wages	$5,613,848	$7,062,530	$7,600,000
General Expenses	$3,206,295	$5,684,122	$6,000,000
Insurance, Taxes and Misc.	$1,852,595	$2,336,438	$2,400,000
Total Operating Expenses	$19,255,938	$26,870,719	$31,400,000
Net Non-Operating Income	$209,968	$316,665	$340,000
Interest Due and Payable	$4,417,727	$6,580,520	$8,275,000
Interest Accumulated Not Due	$3,117,438	$2,203,742	$1,150,000
Net Income Before Depreciation	$7,931,417	$11,473,419	$14,885,000
Payments to Government Cumulative Data			
Interest Due	$9,948,438	$19,642,302	$29,655,000
Interest Paid	$9,839,699	$19,490,956	$29,518,000
Principal Due	$5,462,027	$9,448,658	$14,730,000
Principal Paid	$9,266,946	$18,593,565	$28,744,000
Overdue Amounts—More than 30 days	$137,566	$213,291	$175,000
a. Interest	$82,839	$89,219	$115,000
b. Principal	$54,727	$124,072	$60,000
Advance Payment of Principal	$3,879,689	$9,325,029	$14,112,000

Source of Data: Statistical Reports Published by REA.
1. Special summary of monthly operating reports of REA borrowers.
2. Allotment, construction, operating and financial statistics of REA-financed systems for December 31, 1941 and 1942. These are not complete consolidated statements, inasmuch as all borrowers do not report on all items.
3. REA monthly statistical bulletins.

*Nine months actual in most cases and two to four months estimated. Expense items of REA-financed systems are difficult to estimate because of their rapid expansion and development, and because relationships between income and operating data are not comparable with those of more stabilized enterprises. Figures reflect all information available from borrowers, but not every borrower reports on all items. Data on operating expenses of borrowers' systems are not summarized regularly by the Rural Electrification Administration.

Chronology of 1943

JANUARY

Near-record floods, accompanied by ice and sleet conditions, ushered in New Year, tying up power facilities in many areas in the industrial East.

Maintenance, repairmen ruled essential workers by War Manpower Commission.

Hartford Electric Light Co. announces post-war appliance purchase plan.

Southwest power pool proves stand-by ability. Picks up 66,000 kw. for aluminum plant when Ark-La Electric Co-operative line fails.

President Roosevelt's $109,000,000 war budget omits funds for federal power projects. Only new grant proposed would give REA $30,000,000 additional borrowing credit.

WPB authorizes essential rural line extensions. Rescinds former ban at request of Department of Agriculture to help increase essential food production.

U. S. Circuit Court of Appeals for the Second Circuit upholds death sentence provision of Public Utility act in North American case.

Important changes made in 4th quarter P-46 Forms.

Duquesne Light dedicates new Frank R. Phillips 60,000 kw. power station.

Nikola Tesla dies at age of 86.

National Rural Electric Co-operative Association holds first annual meeting in St. Louis. Delegates from more than 400 co-operatives attend.

Krug assumes his new duties as wartime administrator of utility services.

FEBRUARY

War Manpower Commission revises essential utility jobs. List of 86 cut to 51, but definitions broadened.

District of Columbia Federal District Court in Washington Gas Light case rules OPA evidence on rates must be heard.

Southwest power pool testifies on Defense Plant Corporation aluminum contract at continued FPC hearings. FWA authorized to intervene. National Association of Railroad and Utilities Commissioners vote to intervene.

SEC stock ruling rejected by U. S. Supreme Court in first decision limiting scope of commission's authority. High court holds purchase of stocks by company officers during corporate reorganization is legal transaction.

Shipshaw project in Canada begins to generate power.

WPB Power Division urges utilities to use CMP procedure on metal requirements for construction. Method for integrating CMP mechanisms into existing priority procedures outlined.

Public opposes utility acquisition in Northwest. Washington-Oregon poll shows residents two to one against proposed Columbia Power Administration getting authority to buy or condemn properties.

In first public statement as nation's power "czar," Krug commends job done by utilities in providing adequate power supply at meeting of TVA distributors at Chattanooga.

WPB Chairman Nelson appoints Charles E. Wilson, former General Electric president, executive vice-chairman of the board. Eberstadt out.

Sickler appointed OWU power director.

North American petitions U. S. Supreme Court for review of Circuit Court decision upholding SEC order requiring divestment of all properties. First holding company to challenge constitutionality of "death sentence."

P-46 revision issued as basic utility regulation. Retitled Order U-1.

New bills would create Colorado Power Authority with power to purchase utilities offered for sale.

Bill asks sale of Grand Coulee and Bonneville to states. "Home Rule" of federal power projects is aim of legislation introduced by Rep. Fred Norman, Washington Republican.

Initiative 12 passed by both houses of the Washington State Legislature.

FPC directs Washington Water Power to deliver Bonneville Power Administration energy over company's lines. First use by commission of President's directive calling for "common carrier" transmission of electric power where it would reduce war power costs.

Government seeks cut in rates of Potomac Electric Power. Both OPA and Treasury Department's Procurement Division intervene.

MARCH

Krug appointed vice-chairman of WPB. Continues as director of OWU.

Nine regional "TVAs" proposed. Rankin bill duplicate of one introduced at last session.

Range production halted by WPB.

Fuel oil for power generating cut by OPA. New order requires oil users to hook up with coal or hydro power stations where possible in 17-state eastern coastal area.

Power program up-rated by WPB Requirements Committee. OWU gets "blank check" authority to issue AA-1 ratings on bottleneck items up to $5,000,000 value.

Probe REA tie with organization and expansion of the National Rural Electric Cooperative Association. Representative Dirksen calls Ellis and Slattery before subcommittee meeting.

Texas Legislature probes River Authority Deals. Brazos River district, Guadaloupe-Blanco River Authority and Lower Colorado River Authority transactions on power contracts subject of legislature investigation.

APRIL

"Death Sentence" legality again upheld in court, this time in Commonwealth & Southern case.

Potomac Electric Power ordered by District of Columbia Public Utilities Commission to reduce rates. Sliding-scale agreement again basis for new cut.

Arkansas Department of Public Utilities carries fight for states' rights to Congress in dispute with FPC over rates charged by Arkansas Power & Light for power for Lake Catherine aluminum plant. NARUC intervenes in case.

Portland General Electric files suit to enforce execution of Bonneville contract. Seeks contract without clause giving agency option on properties.

WPB releases refrigerators.

President Roosevelt issues "Hold the Line" message, barring rate increases.

WPB rescinds its "stop work" order halting construction on 32 REA projects.

Commonwealth & Southern ends fight on SEC one-stock order.

OWU revises Utilities Order U-1 to comply with CMP rules.

OCS revamped; Arthur D. Whiteside appointed to head.

Ban copper use in wiring devices. Manufacturers' sales also restricted in Order L-277.

Minnesota outlaws "discount" selling. Important post-war effect on electrical appliance selling seen.

"Death Sentence" test deferred; lack of Supreme Court quorum delays North American hearing.

Colorado Power Authority bill sent to committee.

MAY

U. S. Supreme Court upholds FPC's ruling on Jersey Central Power & Light. Decision seen extending commission's jurisdiction to utilities connected with companies with interstate tie-lines.

WPB officers and utility representatives, meeting in Washington, urge conservation of electricity.

Electric utility construction budgets for 1943 total $539,000,000, FPC reports.

WPB authorizes resumption of work on Keswick Dam. Friant Dam and Madera canal project reinstated.

Texas River Authority Bill goes to Governor for signature.

Contracts for electric energy not subject to renegotiation, War Department rules.

Prompt action by utility companies in Middle West keeps equipment damage and service interruption at minimum in record flood of Mississippi River and tributaries.

JUNE

Electric utilities take stock of probable post-war conditions at annual meeting of Edison Electric Institute in New York.

REA Administrator Harry Slattery advises co-ops to stay out of insurance business; urges them to forego consideration of two insurance companies organized by NRECA.

Krug and representatives of utility industry shelve proposed "brownout" in favor of broad conservation program.

Arkansas Department of Public Utilities takes under advisement cases where utilities seek authority to raise rates to co-ops which take over distribution systems in municipal areas. Arkansas Power & Light and Oklahoma Gas & Electric involved.

Utilities get A-1 gasoline rating in Northeastern shortage area.

Pennsylvania Public Utility Commission votes to permit utilities to earn in excess of 6 percent return on investment during war emergency.

New 125,000 kw. turbine generator put in service at Burlington station of Public Service Electric & Gas of New Jersey.

Order L-65, covering electrical appliances, revised drastically by WPB.

Congress reports resolution calling for probe of Columbia River water storage plans and instructs Representative Coffee, Washington Democrat, to broaden resolution calling for investigation of Shiphsaw and WPB power program.

Northeast power pool meets emergency, when two large machines at Hell Gate station of Consolidated Edison Co. suffer mishap.

JULY

WPB's rubber order R-1, effective July 1, presages early substitution of synthetic for crude rubber in insulation and packeting of wires and cables.

OPA and Treasury Department ask District of Columbia Court to set aside utility commission's $311,000 rate reduction order against Potomac Electric Power.

Secretary of the State of Washington announces that Referendum No. 25, proposing to refer the public power initiative No. 12 to the voters of the state will be placed on 1944 general election ballot.

Senator Shipstead of Minnesota introduces resolution to investigate organization and financing of political groups to influence REA.

Court extends for another year suspension of the Hetch Hetchy injunction.

Army revises regulations on surplus equipment. Return of large supplies of unused property or materials to war production or civilian use provided for.

OCD honors twenty-six utility companies for dimout aid.

Power conservation program agreed upon. Early September set as start for drive. Gets Government indorsement.

OWU announces 1945 power program, calling for installation of approximately 500,000 kw. of generating capacity. Equally divided between public and private stations.

Arkansas Department of Public Utilities grants power companies right to charge standard wholesale-for-resale rates to co-ops which expand to municipal operations. Oklahoma Gas & Electric involved.

OPA loses appeal on rate rise. District of Columbia Court of Appeals denies agency has jurisdiction over utility rates in Washington Gas Light case.

OCR loses jurisdiction over civilian coal, oil. Authority turned over to Interior Secretary Harold L. Ickes.

AUGUST

SEC ruling on participation of common stock in liquidation of holding company upheld by federal court. United Light & Power involved.

WMC list twenty-seven "critical" utility jobs.

OPA allows utilities to fix own ceilings on surplus inventory items sold to another utility.

New OWU order certifies unauthorized extensions. Order U-1-f to provide automatic certification for 90 percent of service extensions calling for capital expenditures of $500 above-ground and $1,500 below ground.

San Diego Gas & Electric cited by Navy for "meritorious wartime service."

Arkansas Utilities Commission amends order on co-op power resale rate rise, involving Oklahoma Gas & Electric.

SEPTEMBER

Southwestern Power Administration established to sell power from Norfork, Pensacola and Denison dams.

FPC cuts Clark County PUD rate contract with Federal Public Housing Authority on Vancouver project by $41,800.

Congress reconvenes. Faces several utility problems.

Bureau of Reclamation divided into six areas. Decentralization plan announced by Interior Secretary Ickes.

Solid Fuels Administrator Ickes orders coal shipments for energy production cut.

Conservation Drive opens on September 15.

NARUC at war conference votes to take to Congress a bill redefining the power of the FPC by amending Federal Power Act.

OWU announces major amendments to Order U-1.

Power equipment gets new scheduling basis in WPB order tightening schedules on components.

Reclamation Bureau and Pacific Gas & Electric sign contract on Shasta Dam power.

Utilities made eligible for OCD awards to be based on "superior" plant protection.

OCTOBER

Western Defense Command eases West Coast dimout restrictions.

Quebec moves to take over Montreal Light, Heat & Power.

Bill introduced in Congress to establish three-man Red River Authority to be appointed by the President to operate Denison Dam recently placed under jurisdiction of Interior Department. Norfork and Pensacola dams may be included.

NARUC's proposed changes in Federal Power Act assailed. FPC calls proposed amendments, voted by commissioners at recent convention, "ripper bills" which would permit utilities to evade federal regulation.

Two Congress power probes get under way. Senate committee seeks funds for REA inquiry. Columbia River investigation turns to analysis of use of electric power in production of aluminum from bauxite and aluminum clays.

U. S. Supreme Court sets aside indefinitely the North American case.

WPB relaxes copper wire restrictions.

Coast dimouts canceled by Army and Navy departments. Atlantic, Pacific and Gulf areas involved. Continuation of conservation urged.

Bureau of Reclamation plans $3,000,000,000 post-war reclamation program.

NOVEMBER

OWU raises upper limit on unauthorized extensions. New order U-1-h raises to $5,000 upper limit on consumer extensions without specific authorization.

Congressional hearings held on Connecticut Dam proposal—third set of hearings, first being held in 1939 and second in 1941.

Coal strike forces Solid Fuels Administration for War to discard plans for 60-day operating base for coal-burning electric utilities.

Administration thwarts investigation of REA. Blocks vote on resolution appropriating $15,000 for Senate agriculture committee probe.

Arkansas-White River control bill introduced in Congress.

FPC rescinds order directing Washington Water Power to transmit Bonneville energy to Army hospital and camp under President's common carrier directive.

DECEMBER

CMP regulation releases materials to repairmen.

REA co-ops face federal income tax in legislation before Congress. Would override previous legislation exempting co-ops from taxation.

OWU simplifies Order U-1. One order canceled and four others amended.

Detroit adopts excise tax on gross revenues to divert federal excess profits taxes of utilities.

Three Arkansas utilities move to place Ark-La Electric Co-operative on a competitive basis. File complaint with state commission, asking board to assume jurisdiction over co-op as being a "public utility."

OCR indicates labor areas will determine limited appliance output. Manufacture of consumer durables on industry-wide basis out for duration.

OPA increases soft coal ceiling prices.

OWU amends conservation plan to allow indoor and outdoor promotional advertising and display sign lighting from dusk until 10 p.m.

Senate opens hearings on investigation of REA "political" character.

Commonwealth Edison completes installation of 147,000 kw. generating unit at Fisk station.

Final unit installed at Bonneville Dam. Tenth generator set as ceremony marks completion of $81,000,000 project.

The Year in Review

A brief resume of developments of the year 1943 which show the effect of the war upon the industry and may indicate trends or have a bearing upon future economy

S. B. WILLIAMS
Editor "Electrical World"

THE STORY of 1943 is the story of an industry all out for war. In reviewing the reported activities of the past year all at one time it was amazing to see to how great an extent the electrical industry had submerged virtually everything to the winning of the war.

Last year was the period of final preparation for maximum war production and as such was necessarily the critical year for war supply. If the utilities could meet the demands of 1943 they could handle anything the war might throw at them—and they did meet these needs with something to spare, not always too comfortable, perhaps, but nevertheless sufficient.

Fortunately, however, the capacity to serve the demands of war, great as it has grown, did not expand to such an extent that after the war it will be a drug on the market. Already the indications are that the end of the war will mark the beginning of a new era of expansion.

The budget, for instance, shows only a modest contemplated capital expenditure for this year, but should Germany be defeated before mid-year and supplies again become available the utilities will sharply increase their expenditures. And among these increased budgets are larger amounts for new generating capacity, thereby refuting the opinion that it may be years before the industry will need any additional capacity.

Operations

For the first time the energy output went over 200 billion kw.-hr. in a calendar year, the total being 221 billion. It was in 1936 that the first hundred-billion milestone was passed, and it is interesting to note that the two years of war added more than 50 billion, two-thirds of which occurred last year, when the rate of output increase was 17 percent.

To help produce this output approximately 3 million kw. new capacity was added, while all capacity was worked longer hours. The average hours use of capacity was over 4,600 hours, which is the first time it has exceeded half the hours in the year. Fuel capacity also set a record, exceeding 4,000 average hours use for the first time.

The generating capacity at the end of the year was just short of 50 million kw., with no change in ratio of fuel and hydro, but with the sharpest gain ever registered in federally owned capacity. An increase of more than a million kilowatts brought federally owned power up to 4,369,000 kw., which with 5,200,000 kw. of locally owned raised public power up to 19.4 percent of the total of the country.

Reports of threatened power shortages bobbed up during the year. Extremely cold weather at the beginning of the year cut down Maine's hydro supply, to offset which temporary cuts in service were ordered. Rumors of pending shortages also came from the Northwest and the Southwest, but none materialized. Nevertheless the national margin of dependable capacity over non-coincident peaks summation dropped from 20.4 percent to 14.7 percent, in spite of 3 million kw. of added capacity. The peaks rose over 4 million kw. to a total in excess of 37 million kw.

Fuel was a major problem during World War I and it has returned to plague us in this war. First, it was oil, and when it looked as though the Navy had licked that problem by removing the U-boat menace the coal situation got bad and it wasn't helped any by the miners. At the beginning of 1943 the utilities had 101 days coal supply on hand; by the end of November, the latest date for which information is available, the supply had dropped to 69 days, or 41 days less supply than twelve months previous. Not only was coal short but it wasn't possible always to get the desired grade. This, coupled with oil-to-coal conversion and with the fact that more of the older and less efficient units ran longer hours last year, caused a poorer over-all fuel efficiency for the first time on record. The figure for last year was 1.34 lb. of coal per kilowatt-hour against 1.31 for the year previous.

The restrictive effect of the war upon the civilian economy is best seen in the customer statistics. An increase of less than two hundred thousand in the number of residential customers indicates the near cessation of residential construction, while a loss of more than 80,000 commercial and industrial customers bears evidence of the inability to do business as usual. The total number of customers at the end of the year stood at a little over 32 million.

But what customers they were. They used a total of 186 billion kw.-hr.! The large light and power sales shot up, going over 100 billion kw.-hr. for the first time,

and despite fewer small commercial and industrial customers they, too, used more energy. The real wonder group, however, was the residential, which, although new appliances were virtually non-existent, showed a larger increase in the average customer consumption than in any single year since 1937.

Revenue set up another milestone, exceeding $3 billion for the first time. The average revenue per residential kilowatt-hour continued its downward path to 3.64 cents.

Operating expenditures rose 12.1 percent, taking the operating ratio before taxes over 40 percent for the first time. Taxes rose less sharply than in the two preceding years, but enough to take more than 25 cents out of every dollar of revenue.

New construction expenditures last year, excluding those that were federally financed, were just a little over $300 million, to finance which the utilities went into the market for less than $10 millions of new money.

Total energy input into REA systems exceeded 2 billion kw.-hr. for the first time, 90 percent of which was purchased at an average cost of 8.5 mills per kilowatt-hour. There was little addition in the way of new lines due to material restriction, but a number of farms along already built lines were connected, bringing the total consumers up to 1,080,000.

Electric manufacturers' production rose a third last year, but new orders were 5 percent below 1942. The production of everything that did not have a direct war use was down, with appliances scraping the bottom. However, as the new year opened there was evidence that the bottom had been passed in the production of consumer goods and that material for a substantial increase might be allocated this year.

Engineering

Continued scarcity of materials and focus upon production for war resulted in restriction of construction operations, development of relatively few disclosable equipments and further increased loading of existing systems. All these factors brought continuation of the expediency and adaptation of the first year of the war. Many of the operating guides which had been initiated during 1942 came to fruition in 1943.

Experience gained through topnotch operation of electrical facilities placed emphasis on limiting factors of heat dissipation, voltage regulation, tie-line load transfers, power-factor correction and system protection. These performance factors set in motion studies which promise to shape the post-war evolution of better than ever equipments, even better co-ordinated into an economic system.

Load Service

Increasing attention was given to keeping equipment in use through maintenance education, appliance swap programs, home education. Food preservation was emphasized.

Toward the end of the year a large part of the sales departments' efforts was devoted to selling the customer on using less rather than more in furtherance of conservation. A voluntary program started in September in place of a mandatory brown-out in order to save coal and transportation principally.

War Operations

Early in the year the Office of War Utilities was created within WPB to handle the war regulation of all utilities, except transportation, with Vice-Chairman J. A. Krug as director, thus giving utilities an important place in the war production program.

As the year progressed, numerous changes were made in the war regulations, principally to meet current conditions. One of the first things was to recognize the food shortage problem and allow more materials for rural extensions and later to rescind the ban on some 32 co-op lines.

Greater controls were placed on inventory and exchange of excess stocks was made mandatory. More than $25 millions has been redistributed so far.

Limitations on the use of material for non-direct war use, which were very tight in the first half of the year, were eased up gradually in the latter part of 1943, accelerating as surpluses of materials began to appear. This was particularly true of copper. By December controlling factors were manpower and public psychology.

WMC revised the essential list of utility jobs, dropping the non-operating. To save manpower, testing period in the meter code was lengthened to eight years.

Dimouts, which had plagued both coasts, were canceled as of November 1.

The public in several states, disliking War Time, began efforts to switch back to Standard Time and such legislation was passed in Illinois, Michigan, Ohio and Georgia.

Disintegration

Disintegration of holding companies under the act went into its final stages last year, with two of the largest systems, U.G.I. and North American, voting to dissolve and with other systems accelerating the disposal of their properties.

Thirty-two divestments of holding company property were reported by SEC. Of these but nine, or less than 30 percent, represented sales to cities, PUDs or co-ops. The remaining 70 percent remained in private ownership. Most of the divestments were accomplished by mergers, but in a number of cases, either through exchange of stock or stock dividends or public sale, operating properties became independent of all holding company ties.

The fears that dismemberment of holding companies would result in a large increase in public ownership have not been borne out so far. During the past year several small pieces have been sold to co-ops and a larger deal in Missouri has received the blessing of the state commission; a few cities have purchased holdings, but nothing large.

There has always been some question as to the legal right of REA to lend money to co-ops to purchase utility property, and to cover this and extend the area of permissible purchases a bill has been introduced in Congress.

Regulation

Several new angles to regulations came up last year. The Army in the past fiscal year reported savings from power renegotiation of close to $4 million. FPC invoked the President's common carrier directive against Washington Water Power, but later in the year rescinded it on the basis that the loads were too small. Detroit, failing through the commission and the courts to force Detroit Edison to return taxable excess profits to consumers, enacted a 20 percent excise tax against utilities. Fuel clauses and other automatic rate adjustments were ruled by OPA to be subject to the anti-inflation act. Wisconsin commission denied OPA authority over rate decrease petition.

A return of 5½ percent was declared fair by the New York commission, while Pennsylvania allowed over 6 percent because of utilities' need for equipment after the war.

Rate reductions, in spite of the times, were numerous and those recorded amount to around $6 million. Penalty charges were discontinued in Alabama and cut in half in Kansas.

In several states the question of co-op status when going outside its membership for business came up. Arkansas granted permission to charge standard wholesale rates to co-ops expanding to municipal operations one month and withdrew it the next.

FPC continued active in the matter of write-downs, ordering close to half a billion dollars to be taken out of utilities' book values.

States' rights was brought to the fore by the FPC investigation in the rates charged in Arkansas to the aluminum plant. National Association of Railroad and Utilities Commissioners intervened. After the Supreme Court decision in the New Jersey case NARUC voted to ask Congress to clarify the Federal Power Act through amendment to prevent FPC encroachment on state authorities' rights.

Public Power

There was less agitation for municipal ownership last year than in any year since the New Deal came in. In all twelve elections were reported—three for and nine against M.O.

Nevertheless proponents of public power continued active. Bills were offered to establish the White River Authority, Red River Authority, nine regional authorities. Washington State voted to permit PUDs to form joint commissions to buy up properties. Control of Denison Grand River and Norfork dams went to Department of Interior, which formed Southwestern Power Administration to market power.

During the year the federal power program was subject to considerable investigation. A Senate probe of the entire federal hydro program was asked, but later shelved. Investigations did get under way, however, on REA, Columbia River, Shipshaw and Grand River flood control. In Texas the Legislature investigated the public power activities in the state and voted a mild curb on river authorities.

Taxes

The most outstanding feature of the year was the growing evidence of the need for some way to tax public power. Such a bill was passed in Georgia but vetoed. A similar bill in Ohio was killed. A tax bill in the Senate had a provision for accounting by tax-exempt agencies. Bills to tax co-ops were offered in several states, while the Court of Appeals ruled that they were subject to property and franchise taxes. The novelty of the year was Detroit's 20 percent excise tax against utility gross to absorb federal excess profits taxes.

Legal

Supreme Court voted to review decision of lower court upholding 11(b)(1) of utility act, commonly known as the "death sentence," but has been unable to do anything because so many justices have disqualified themselves. In the Jersey Central case the court extended FPC jurisdiction to utilities connected to companies having interstate ties regardless of whether the intrastate company has control over interstate delivery. In two cases the court killed aspirations of local political bodies to get into the power business cheap by allowing valuations too high to be attractive.

In the lower courts OPA was denied jurisdiction on rates, but a ruling was made that its evidence must be heard. The Oregon Supreme Court ruled that a PUD could operate outside its own boundaries. The contention of SEC that the common-stock holder has participation rights under death sentence liquidation was upheld.

The first strike to stop any power service since Pearl Harbor occurred late in the year in two plants in Pennsylvania. A threatened strike against five central utilities was withdrawn.

Electrical manufacturers were conspicuous during the year for the large number of Army-Navy "E"s they received for excellence in the war effort. These awards are not open to utilities, but San Diego Gas & Electric was cited by the Navy for meritorious wartime service. This was the first such recognition from the armed services to utilities.

Outside the splendid job the industry has done in the war effort, the thing that stands out for the year is a general return of public confidence in private ownership and management. This was expressed in many ways, not the least of which was the critical attitude toward public power and the growing desire to tax it. It is a very sound and healthy situation for the resumption of normal business.

Electrical Manufacturers in Transition

Review of the year 1943 shows production increase of one-third—Several groups of manufacturers have post-war plans for co-operative market development

LEONARD KEBLER
President National Electrical Manufacturers Association

THE YEAR 1943 will always be remembered as the great year of expansion for war production in the electrical manufacturing industry. Electrical manufacturers are still, and for some time to come will be, almost completely concentrated on the manufacture of war goods, both electrical and non-electrical.

They may well be proud of their performance during the past year, for their total production of electrical and non-electrical products rose to the almost incredible height of 33⅓ percent above 1942 production. This increase looms large when it is recalled that 1942 volume was 50 percent above 1941, which in turn was almost double 1940.

The production of various electrical products reached astonishing totals. The index of production for electric motors and generators shows this story—1940, 100; 1941, 175; 1942, 250; 1943, 380. Electrical insulating materials, such as mica, laminated products, porcelain, vulcanized fibre and varnished fabric and paper, were produced as never before, the index for shipments billed being—1940, 100; 1941, 195; 1942, 265, and 1943, 340. Some other items produced in record quantities were: Asbestos insulated power cable, industrial controllers, magnet wire, X-ray apparatus, telephone apparatus and measuring instruments.

In contrast, the volume of production of most appliances was practically nil, while sales of stocks on hand fell off to small fractions of the sales volume of previous years. The manufacturers of such appliances, incidentally, accounted for a very large part of the electrical manufacturing industry's production of non-electrical war goods.

Material and Manpower Problems

The fact that electrical manufacturers were able to reach new production heights in 1943 does not imply that they had no problems to overcome. As they became more and more successful in coping with the problems of material shortages and material substitutions, manpower shortages and problems became more and more acute, making it difficult to meet production demands. For the present, and probably for another four to six months, they are the greatest immediate problem confronting each individual company.

NEMA

It is believed that NEMA has made a substantial contribution to the successful efforts of the industry. Acting for the benefit of all members of the electrical manufacturing industry, NEMA has persisted in its wartime objective, namely, "to assist in every practicable way the successful prosecution of the war."

The facilities of the association have been used effectively in connection with such problems as emergency standards for electrical products, federal specifications, conservation and substitution of critical materials, job rating, training programs, replacement schedules and manning tables, wage, hour, overtime and other basic regulations relating to war contracts, priorities and materials allocation, and other important subjects, and in the provision of statistical data needed to help solve the war problems.

The association has continued one of its most important services to the industry, namely, that of acting as a facilitating and liaison agency between the electrical manufacturing industry and all governmental war agencies.

Postwar Problems

While the industry is continuing to devote its efforts toward helping win the war, serious consideration must be and is being given to such very perplexing post-war problems as termination of war contracts, disposal of surplus war materiel, reconversion, and recapture of pre-war markets.

For most electrical manufacturing plants, reconversion is a relatively simple problem because the companies have continued to manufacture the same general line of products. The greater part of the industry did not find it necessary to convert to war production.

On the other hand, some portions of the industry, particularly electrical appliance manufacturers, ceased entirely to make their peacetime products and did convert all their facilities to the production of war goods, usually

non-electrical war goods. It is this group that will need the most time to reconvert—periods ranging from three to six months.

There is, of course, much speculation regarding the volume of business that will be available to manufacturers of electrical products after the war, which seems to depend upon several factors:

1. The replacement market for worn-out electrical apparatus and appliances.
2. The volume of delayed buying of new apparatus and appliances which cannot be met during the war.
3. The success of post-war home building programs.
4. The application and acceptance of new electrical products, the development of which have been speeded to meet war needs.
5. The continuation and success of electrification programs carried on prior to the war, such as residential adequate wiring, farm electrification, and of new programs which may be started.

Post-war Program

The electrical industry enjoys an enviable record among industries for its ability to organize and undertake, co-operatively, programs for expansion of its markets. A consequent result is the maintenance of employment, increase of efficiency, improvement of working conditions, and still further raising of the American standard of living.

A number of NEMA sections are already well advanced in their plans to expand markets after the war. Even the manufacturers of certain electrical products who earlier may have looked forward to sharply declining production because of the marketing of surplus stocks have begun to take heart and see in the future real opportunities because of the need to restore industrial plants of the devastated and warring countries.

It is most encouraging to see this brand of forward thinking of electrical manufacturers of all kinds of apparatus, equipment and appliances. Many who in more peaceful times may not have realized the necessity for aggressive planning and for co-operative sales promotion activity now see that the need exists. Only by joint effort can they meet the competition which will be forthcoming from other aggressive industries, which are after their full share of the consumer dollar.

During 1943 NEMA has reorganized its various committees dealing with post-war problems, and these have been supplemented by similar committees appointed by a number of NEMA sections.

It is noteworthy that the Electronics Section is now developing a comprehensive service program, part of which is a project designed to make available exact information on applications in specific industries.

Similarly, the Industrial and Commercial Lighting Equipment Section is planning an International Lighting Exposition and Congress, now tentatively scheduled to be held in the autumn of 1944 in Chicago.

The Street and Highway Lighting Safety Bureau is developing plans for special services to electric utilities.

Leonard Kebler

The anticipated huge home construction market indicates the need for an immediately expanded National Adequate Wiring Program, in which, as during the past six years, utility companies will play a leading role in the local and sectional promotional activities.

The Electric Range and Electric Water Heating Sections have already launched a co-operative advertising and publicity program designed to promote interest in and acceptance for their specific products when they again become available in the national market.

The Farm Electrification Bureau, which has been conducting a program of informative publicity, is now giving serious consideration to plans, which may be formulated immediately after the European phase of the war ends, to expand the use of electricity on farms now receiving service.

Conclusion

The past year has been dominated almost entirely by expansion of production for war, and the expanded production must not lag in 1944, but it is the feeling that 1944 will also require much thought about methods for keeping the economy of our country at something approximating its present high level, together with consideration of the problems incident to re-entry into production of goods for civilian purposes, and effective and equitable policies and methods of reconversion. The electrical manufacturing industry, while continuing all efforts necessary to aid in bringing the war to an early and successful conclusion, must and will devote the time and effort necessary to minimizing the economic disturbances which an ending of the war might otherwise create.

Editorials

S. B. WILLIAMS, *Editor*

A Refreshened View of Opportunity

THE FIRST annual statistics of the utility industry were published forty years ago. They were census data covering the year 1902. In this issue we present the data for the year 1943, forty-one years later.

In the two generations the output has grown from 2½ billion to 212 billion kilowatt-hours—almost one hundred-fold. Half of that increase came in the last seven years, a quarter of it in the last two years.

At the turn of the century, when the output was breaking into its second billion, this was the great industry of promise for young men. The men who then had the vision are grown old and the third generation is coming up, but its vision, its dreams are elsewhere.

Forty years ago those young men of vision had big dreams, but nothing like hundreds of billions of kilowatt-hours in their lifetime, any more than we can conjure up visions of 20 trillions of kilowatt-hours in our lifetimes. The difference is that they had a vision of expanding opportunity in electric service and our young men do not, in spite of the fact that we accomplish in one year's expansion what they struggled to do in a whole generation.

Is our present growth something that just happened, is it but the momentum of a snowball that some one else made and pushed? An examination of the figures show that generating equipment forty years ago operated, on the average, approximately 500 hours a year, or less than one hour and a half a day; last year it was nearer 5,000 hours. Forty years ago there was little service of the customer in the daytime; last year it was around the clock.

When today's 10 percent expansion is ten times greater than the entire output of fifty years ago, how can one question the opportunities of the future? Surely the mere task of finding means to effect today's 10 percent increase is in itself large.

Nevertheless, the young men both within and without the industry do not see it and it is somebody's job to make them see. Management, busy as it is, must take time away from today to look at tomorrow. If management's faith is wavering, it should read and digest the performances of 1943 as shown in this issue. And to make sure that it understands the full import of these data it should call for the record at the beginning of each generation, of 1923 and 1903. It should go back in its own operations and ask itself if better or poorer men are needed for 1944 than were needed for 1924 or 1904. And if the answer is what we think it will be, then let management say out loud what this business offers young men. If management is inspired by the record, if management can get a refreshened vision of opportunity, it should find ways of transmitting this inspiration to its people.

Rate Regulation Resulting From Hope Gas Decision

A FEW DAYS after the Supreme Court had handed down its recent decision in the Hope Natural Gas case the chairman of the Federal Power Commission is reported to have said in an interview that it marked the beginning of a large number of rate reductions. It is hard to say whether he is right or whether it is a case of the wish being father to the thought. Aside from the fact that it was extremely unjudicial for one without jurisdiction to inject biased thinking into the already muddled waters of states' rights, let us examine the situation.

Undoubtedly the remarks referred to were made with write-downs to meet historical cost in mind. A hasty examination of a number of write-down orders of last year reveal a reduction in allowable investment of approximately 25 percent. This issue also discloses an operating ratio slightly in excess of 40 percent before taxes, depreciation 11 percent and fixed charges 9.1 percent. Add to this pre-Pearl Harbor taxes of 21 percent and we get a total in excess of 80 percent.

All that is left of gross is 20 percent. How much of that can be cut to accommodate a reduction of 25 percent in rate base?

An uncertain financial condition is faced in the post-war period. There are no indications that prices of labor or fuel will be reduced and it is conceivable that the operating ratio may go still higher, at least for a time. Will the state commissions be inclined to base their calculation on today's extraordinary conditions or on the more realistic post-war conditions?

There will in all probability be some rate reductions as the result of this decision, but we feel that most commissions will be inclined not to be too hasty in seeking lower rates but will wait until they can get a better slant on the conditions under which a rate cut will become effective.

The state commissions generally have shown great restraint in rate matters during the past two years of greatly augmented earnings. There is no reason to believe that they will now act with any less restraint just because the Supreme Court has given them a free hand in utility evaluation.

Hardly Any New Financing Needed

ONLY TWICE before since the turn of the century is it recorded that the electric utility industry has gone to the investor for less than ten millions of new capital, and that was at the bottom of the depression. Never before has the industry gone to the investor for a smaller part of its requirements for capital expenditures for new construction than last year. At a time when it was expending for new construction around three hundred millions it asked for less than ten millions of new capital.

Even so the industry could have spent considerably more without additional outside financing and, in fact, this condition may be found to prevail during the next few years.

This use of reserves, which in the past few years have been larger than formerly, will make it possible for the industry to expand considerably after the war without competing for new capital. Until the industry begins to spend for new construction in excess of three-quarters of a billion a year, it is unlikely that it will have to find new financing for much more than a third of its needs. This is the reverse of the practice prior to the depression, when two-thirds or more had to be raised by new financing.

Contributions to Fuel Conservation

LAST YEAR we drew attention to the remarkable improvement that had been made since the middle of the '30s in decreasing losses in the distribution of electrical energy. Again we wish to emphasize the point because of the importance of it this year in the fuel conservation program.

Distribution efficiency improved last year by 1.2 percent, which means that an additional 2¾ billion kilowatt-hours were saved. If we take two-thirds of this as representing the energy produced by fuel and at last year's fuel efficiency of 1.34 lb. of coal per kilowatt-hour, we get a saving of 1.2 million tons of coal during 1943, or of its fuel equivalent.

While much of this decreased loss ratio is due to the increased loading and longer hours use, there has been a trend in improved distribution efficiency that will continue. This is a phase of the conservation program to which the critics of the electric power industry have given no attention.

Savings in fuel transportation and demands on fuel production were also made through the reduction of coal piles from 110 days to the 69 days supply on hand December 1. Add these together and the electric utility has some positive savings to show. Can any other group in the conservation program do as well?

However, even if the electric utility industry is doing an outstanding job in fuel conservation, the fact remains that there will be a critical fuel situation until the demands for space heating fall off in the spring. Therefore, the utilities must make further and continuing efforts to get public compliance. It is highly doubtful if the urgent need for conservation will continue past the space-heating period, but so long as the need exists, let it not be said that the power companies gave anything less than full support to the program.

Post-War Meter Test Periods

FOR THE DURATION, the utilities in many states have been authorized officially to extend the time between tests of meters from the pre-war interval of three to six years to as long as seven or eight years. That sanction is proving a great help in the face of a manpower shortage and would probably not have been granted if the regulatory authorities did not have faith in the enduring accuracy of the induction watt-hour meter.

Quite naturally the issue will arise as to the test periods to be set for the post-war era. There is ample merit in the feeling that the earlier requirements were unnecessarily exacting. But mere feeling is weak as evidence in a hearing where the issue is reviewed. Statistical proof is what it usually takes and it should be assembled now and analyzed to determine how the data can be most convincingly presented.

Fortunately for the skeleton staffs that meter departments now have, the accumulation of the requisite data need involve no great amount of field work. Information already in the meter history and test files will be found to have most of the answer.

The dominant factor appears to be this—what percent of the total of meters outstanding stay in one location through two or more of the prescribed test periods and what fraction of those show no necessity for adjustment to be kept within prescribed limits of accuracy? Therein resides definite proof that the watt-hour meters retain their accuracy over considerably longer time than the length of the pre-war test periods. Those meters which do not remain in place into a second period usually get a shop test and are readjusted if necessary. Such meters are hardly any factor in consideration of long-sustained accuracy because they do not stay long enough to find out what they would do if they should stay longer. If, however, it should be demonstrated that nine and a large fraction out of every ten still were legally accurate after the first long-interval tests, and even nine out of ten were found so on the second or third test, it should surely sway those who urge resumption of the relatively short pre-war period.

It is probably true that the vagaries of the old commutator-type d.c. meters set the test pattern for the pioneering designs of the induction watt-hour meter and thus the present requirements have not taken due cognizance of the totally different nature of the modern induction watt-hour meter. It is equally true that the test-in-place requirement is a holdover from the d.c. era. It should not be hard to demonstrate that shop tests are sufficient for all but the larger commercial and power meters and that mobile-unit testing may be warrantable.

Washington Comment

By R. N. LARKIN, Washington Correspondent

Public Power Angling for War Industry Plants

PRESIDENT ROOSEVELT recently discarded the term "New Deal" as a designation for his political organization. He has not, of course, discarded all the aims and ideals of that organization, and the electric power industry will find the effort to extend public ownership going on "as usual" under whatever new name replaces the discarded "New Deal."

The following letter, dated December 7, and addressed by the President to Secretary of Commerce Jesse H. Jones, may resolve any doubts as to the continuation of "New Deal" practices relative to the electric power industry under whatever the party's new name may prove to be:

The White House

MY DEAR MR. JONES:

In October I requested from the Secretaries of War and the Navy lists of electric generating plants constructed by their respective departments during the present emergency. I have in mind that such plants may be utilized after the war in connection with existing public power systems.

I believe the Defense Plant Corporation may have some power plants under its control. If so, I would appreciate your sending me a list of them, together with any suggestions you may have for their post-war operation in the public interest.

Sincerely yours,

FRANKLIN D. ROOSEVELT.

The list of DPC power plants will not yield so fertile a crop as did the inquiry made of War Secretary Stimson (ELECTRICAL WORLD, November 27, page 58). DPC actually controls only about nine plants, or less than half those controlled by the Army. The Navy is considered to be generally unproductive for post-war expansion of existing public systems, for most of its generating capacity is installed in navy yards, which, it is to be presumed, will continue in large measure to operate after this war as they have during the war. Certainly if the United States maintains a seven-ocean Navy after the war, the public systems can expect little help from this source.

The DPC holdings, two of which are huge, are pretty well concentrated along the Gulf Coast. Four steam plants, with a total installed capacity of about 275,000 kw., are located within approximately 200 miles of each other in this region. Another plant of 6,000 kw., lies about 250 miles to the north in Arkansas, admirably situated for interconnection with the Southwest Power Administration, which markets power from Pensacola, Norfork and Denison dams. This station is hardly more than 150 miles from any of the three SPA dams, yet so located as to be an excellent public wedge into private lines. A sixth DPC plant, of 12,000 kw., is located in Michigan, and quite possibly could be tied in with REA systems of that state.

Then there are, or will be unless contracts for them are canceled, three floating power plants of 30,000 kw. each, which can be towed to any point on any stream which will accommodate a barge of moderate draft and a tug to tow it.

Some Not Suitable

Not all of this DPC line-up is the type of equipment normally installed in a utility system. Some of it is dependent on waste-heat boilers for steam, and other stations find turbines exhausting steam at high back pressure for processing work. How feasible such equipment would be for purely power system operation is open to question. Then, too, it is not unlikely that some of the industrial operations currently using this capacity may be continued after the war, since these operations are not so strictly of a war nature as are Army Ordnance plants. Still, DPC has more than 365,000 kw. of steam capacity, and this is considered nothing to trifle with in public ownership circles.

In the meantime actual implementation of the President's wishes for capacity at Army Ordnance plants progresses, although slowly. Since the war will not be over next week, neither the Interior Department nor the Army is rushing to completion an agreement concerning the Oklahoma Ordnance Works, which, being next door to Pensacola Dam, gave Interior its original idea about making post-war use of war-born generation plants. An agreement is in the making, however.

While little "firm policy" in this matter has yet been decided upon by Interior, the thinking is that the department will not attempt to set up one set of rules for the acquisition of all plants which could be tied into existing or proposed Interior systems. In some cases Interior sees nothing but an outright transfer of title between the current federal owner and Interior. In other cases it is foreseen that there would be no such transfer, but perhaps a lease, or a rental agreement. Or there might be only a marketing agreement, whereby Interior would sell such power as the station had to sell. There might merely be an interchange agreement. Interior is not choosy along this line—so long as it gets what there is to be had.

Walking Warily

It is obviously too early to do more than speculate about the terms on which outright transfers between agencies might be made, but there is a feeling in responsible Interior quarters which is unequivocally opposed to any $1 sales of generating facilities. Obviously if a $5,000,000 war-born generating station were to be charged off to the war and transferred to Interior at $1, Interior would be able to destroy any private competition. There is feeling in the Interior Department that any such move would be a colossal blunder. Likewise if such a transaction were to be made, but rates were to be based on full valuation, there is the feeling Interior would be guilty of rate base inflation. In either case, it does not now seem likely that any $1 transactions will be sought by Interior, although Interior people feel that any cost settlement which might be made would be attacked by advocates of private ownership.

NEWS OF THE WEEK

Office of War Utilities Issues New Order U-1

New version of Order U-1 with numerous changes aimed at simplifying controls on utilities emerges this week — Will mean big reduction in paper work necessary

A new version of Order U-1, with numerous changes aimed at simplifying controls on utilities and reducing the amount of paper work necessary for compliance, was issued this week by the Office of War Utilities.

Small Materials Increase

The new U-1 does not open the materials floodgates to the extent that might have been expected with the vastly improved material supply situation, but it does allow a small increase in use of materials, principally through the increase from $500 to $1,500 in the amount expendable on minor plant additions and in the exemption from delivery quotas of material withdrawn from excess inventory.

Utilities whose inventories, as defined, are valued at $10,000 or less are exempted from restrictions on purchasing and maintaining inventories, but the order is so drawn as to bring them under these restrictions automatically when their inventory goes above $10,000.

All restrictions on withdrawals from inventory are removed from the new version and material quotas now apply only to purchases. However, material may be withdrawn from inventory only for permitted uses, which are the same as in the September 24 version of U-1 except for the increase to $1,500 in the value of allowable minor plant additions.

Extensions to consumer premises under orders supplementary to U-1 are now considered minor capital additions and not operating supplies, as heretofore. Also, considered minor plant additions are plant improvements whose net material cost is not greater than $1,500.

Automatic preference ratings are somewhat altered to allow an AA-1 rating on all MRO supplies or supplies for minor plant additions, except those materials in the transmission and distribution class. AA-1 may be used in this class to obtain materials for the repair of an actual or imminent breakdown, but for MRO uses and plant additions transmissions and distribution material must be obtained on an automatic AA-3 rating.

Utilities are not required to recalculate their purchasing or inventory bases under the new U-1. An incentive to draw down excess inventory stocks is contained in the provision which exempts deliveries from a utility's own excess, or excess stocks of another utility, from the scheduled delivery quota.

Delivery Quotas Regulated

Delivery quotas are now regulated by scheduling rather than by acceptance of shipments. As long as purchases are scheduled within quota restrictions, there is no control over the delivery date, and all allowable purchases may be received in any quarter without violation of the order.

Sales of materials are no longer regulated by Priorities Regulations 1 and 13, but are under the jurisdiction only of U-1.

Schedules of the order have been revised to include scheduling and inventory quotas. Schedule A remains the same, delineating classes of materials. Schedule B of the new order defines delivery quotas. Schedule C defines the limits on practical working minimum inventory, and Schedule D lists the items to be cleared with regional engineers before their purchase from a commercial supplier. This list of items has been halved and now contains only eight items, whereas its predecessor, Schedule C of the September 24 version, contained 17 items.

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WPB Calls Halt on Power Extension

WPB's decision to continue restrictions on new construction and facilities until "the probable future course of the war becomes clearer" has brought to a halt any ideas about extensive additions to the nation's electric power generating capacity.

The decision, hammered through by the services over contrary recommendations of some civilian agencies which hold membership on the actual War Production Board, will not affect power projects already scheduled, and will not preclude occasional additions to the program considered necessary by the Office of War Utilities and approved by WPB's requirements committee. It will, however, stop any plans for a broad relaxation of the controls governing installation of new power facilities, and it serves definite notice to power systems, public and private, which construed the easier materials situation to mean a green light for substantial additions to capacity, that the war has not yet reached the stage at which such substantial additions may be allowed.

WPB's decision was announced by Chairman Donald M. Nelson with the statement that:

"Construction has been sharply curtailed during the last year. The entire situation was given full consideration at

today's board meeting, and it was unanimously agreed that there must be no modification of the restrictions until we can be certain, from the course of the war, that such modification would not harm the war production program."

Meanwhile, in line with its policy of correcting local situations wherever possible, the Office of War Utilities has approved the installation of two small generators in industrial plants. A 1,000-kw. steam unit will be installed in the Rochester, N. Y., plant of the Gleason Works, and a 4,000-kw. steam unit will be installed in the West Point, Va., plant of the Chesapeake Corp.

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Price Fight Over Consumer Durables

Pricing of consumer durable goods which will be made this year as industry reconverts from war to peace was the cause of one of Washington's numerous non-military headaches this week.

So sharp had been the first brief interagency fight over pricing that some observers predicted that failure to have an acceptable pricing formula ready for the first major production programs under the reconversion program would constitute a real hindrance to the budding shift to peacetime production in some industries.

It was indicated by officials of several of the war agencies concerned that Economic Stabilizer Fred M. Vinson would shortly issue a directive defining the terms on which "reconversion goods" are to be priced.

The program for 2,000,000 electric irons, first major reconversion program affecting civilian consumers, was slowed by absence of a clear-cut pricing formula. It was believed that producers who choose to sell them at March, 1942, levels may do so.

The trouble started when one OPA official attempted to apply to the pricing of the forthcoming irons the terms of a directive issued by Vinson to remedy a specific local situation in the textile industry. The directive allowed producers whose profits from all operations are no more than double those earned during a 1936-1939 base period, or who are operating at a loss, to produce at cost plus a 2 percent markup. Producers whose profits were greater than those of the base period would be required to produce at cost.

The OPA official asked WPB's Office of Civilian Requirements for a list of essential civilian goods to which this might apply, and was flatly refused. As a result, it is expected that Vinson will issue a directive modeled along these lines, but broadened somewhat to fit the needs of hard goods manufacturers. Pending such action or some other clarification, the iron program is without direction as to price.

CROSSING MILLION-KILOWATT MARK—Watching the system load meter cross the million-kilowatt mark for the first time in company history, recently, is Charles P. Hubbard, chief system supervisor of the Detroit Edison Company. The recorded load at the time (November 5) was 1,010,200 kw. This was seven times the figure during World War I. By December 10 Detroit system peak had reached 1,010,700 kw.

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A. P. & L. Abandons Blakely Dam Plan

Its license revoked by the Federal Power Commission, Arkansas Power & Light Co. has abandoned plans to construct the $11,000,000 Blakely mountain dam on the Ouachita river above its Carpenter and Remmel hydro-electric stations, President C. H. Moses has announced. The dam had been projected as a dual-purpose dam and Congress had appropriated $2,000,000 for the flood-control portion.

"We have written off our books about $1,000,000 as an economic loss on the project," Mr. Moses said, adding that the company still retains title to about 30,000 acres of land in the proposed reservoir for the dam.

"From a strictly flood-control standpoint, I think that Blakely Dam would be justified and would benefit our Carpenter and Remmel dams, but from a power development standpoint we do not now think it economically feasible," he said. He asserted that if the FPC had not revoked the company's license the dam probably would now be under construction.

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Early Decision on Flood Control Asked

Congressman Brooks Hays, Arkansas Democrat, has called for early decision on the type of control that shall be exercised over flood control dams in the Arkansas River valley, construction of which at the earliest possible moment he termed "imperative."

Emphasizing that flood control is the paramount necessity for his district (the 5th), Hays expressed the belief that "we are capable of maintaining the proper balance between federal and state governments, and should avoid going to either extreme." Flood control, he said, is a national problem since floods don't recognize state boundaries. Its solution must be approached with the idea of serving all interests without discrimination. One suggestion, he said, would be to have the valley's flood control works under the jurisdiction of a board appointed federally, but whose members had been approved by interested state governments.

"I believe," Hays asserted, "that Congress can exercise a better protection in this respect through an independent bipartisan agency than through one of the departments which will follow customary executive controls."

Hays added that whatever is done should be done "without injustice to private power companies," although he said it would not be sound public policy to restrict power sales by publicly owned agencies to wholesale distribution. He declared his belief in the possibility of arriving at equitable relations between public and private power sources with the comment:

"I am confident that this can be done in the Southwest. This question of relationships is something we have often been afraid to approach, but in the solution of post-war problems it can hardly be avoided. If we could think in terms of influence rather than domination, it would help. It would be wholesome for government to think less of dominating private business and more of co-operating with it, and at the same time business leadership should see the possibility of influencing government policy rather than staking everything on domination."

Former REA Engineer Before Senate Committee

Existing REA policy would justify use of "precious metals" for conductor in rural electrification projects, former REA engineer told Shipstead committee, investigating REA, this week

Existing REA policy would justify the use of "precious metals" for conductor in rural electrification projects if it was believed such a system could be self-liquidating, a former Rural Electrification Administration engineer told the Shipstead committee, investigating REA, this week.

Policy Reaffirmed

The policy, promulgated on December 21, 1939, by REA Administrator Harry Slattery, at the "suggestion" of Paul Appleby, Assistant to the Secretary of Agriculture, was reaffirmed last December 28 by Deputy REA Administrator William J. Neal, the committee was told, as copies of the orders went into the record.

The witness, Lieut.-Commander Ben W. Creim, U.S.N., testified that the policy is "absolutely contrary to the early precepts of rural electrification," and, with the comment that it "nullifies all the engineering and technical experience REA has developed," added: "It puts rural electrification development in the same status it occupied before the REA Act."

The policy, according to copies of directives promulgating it which went into the record, is as follows:

"Effective immediately, a selection of conductor for Rural Electrification Administration projects shall be guided by the following statement of policy. The engineering division is specifically charged with the duty of keeping its personnel fully informed of this policy and acting in conformity with it."

"1. An REA as a lending agency in approving conductor design should be concerned only with the assurance that the cost of construction will not exceed the capacity of the project to pay out. This should not prevent the Rural Electrification Administration from designing uniform standards which may be for purposes which would serve to lower the cost of construction, to lower the cost of maintenance and assure longevity.

"2. The responsibility for the selection among suitable designs must rest with the co-operative. If the co-operative pre-selects a conductor material, there should be submitted by its engineer a study to show that this type of material is the most economical through the life of the project."

(Signed) HARRY SLATTERY,
Administrator.

Creim testified that, in his opinion, co-operative engineers would be unable to comply with the requirement of Section 2 of the directive, which requires a justification of any pre-selected material as "the most economical throughout the life of the project." Such justification, he said, would be impossible because composite conductor has not yet been in use for as many years as a project might be expected to last, "has not yet been through one life cycle." Engineers, he added, do not really know how long composite conductor will last. Thus, he concluded, "such data could only be opinionated and not based on engineering data."

Senator Henrik Shipstead, Minnesota Republican and instigator of the investigation, declared the policy would eliminate REA from "having anything to do with protecting its loans."

"Startling" to Gillette

Senator Guy M. Gillette, Iowa Democrat, after listening to Creim's testimony relative to his experience with apparent attempts by representatives of the Copper Wire Engineering Association to insure that copper conductor be used on specific co-op projects, declared it "startling" to find REA employees participating in actions designed to insure the use of copper. Gillette said he had no quarrel with CWEA men for attempting to sell their goods or for attempting to have specifications so drawn that their goods could compete more favorably, but found "startling" participation in such moves by REA employees.

Thomas Testimony

Creim was followed to the stand by L. A. Thomas, current head of REA's design and specifications unit, who testified at length to differences of opinion on technical matters between himself and Guy Thaxton, REA Chief Engineer, as well as Thaxton's assistant, J. K. O'Shaughnessy. He testified that a

POST WAR PLANNERS—Industry representatives consider market prospects for electrical merchandise and service after the present emergency terminates, the setting being at a meeting of the Electrical Manufacturers Club of New England in Boston January 10. L. to r., Herbert Metz, lamp and lighting sales manager, Graybar Electric, New York, and chairman Adequate Wiring Bureau; L. L. Edgar, vice-president Boston Edison; J. M. Newton, Holyoke, Mass., past-president National Electrical Wholesalers Association, and Floyd D. Campbell, president New England Gas & Electric Association, Cambridge. Mr. Metz, principal electrical speaker, told 375 members and guests that a pent-up demand for household appliances points to a prosperous America, citing results of recent surveys to indicate a forthcoming flood of orders to maintain and raise living standards

clause in a contract between an REA co-op and the supplier of its conductor which held the supplier responsible for the conductor's performance under stipulated conditions was ordered stricken from the contract about two months after the document was signed.

This testimony was given as Committee Counsel Carroll L. Beedy was developing Thomas' story of an investigation he made of conductor troubles suffered by the Stamford Electric Co-operative of Stamford, Texas, known as Texas-99-Jones. Study of conditions existing on this system and on neighboring co-op systems convinced him, Thomas told the committee, that armor rods were required on the system. He explained that armor rods are accessories to which copper suppliers object as adding to the cost of their material and thereby infringing on its competitive position.

Beedy introduced three engineering orders issued by REA with which Thomas differed on technical grounds in an endeavor to show that REA employees have relaxed constituted REA standards so as to improve the competitive position of copper conductor as opposed to aluminum or other composite conductor.

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Canadians Oppose Expropriation Plan

Results of a poll taken among thousands of persons in all districts of Montreal disclose that 95 percent of those canvassed are opposed to government ownership of the Montreal Light, Heat & Power Consolidated. The figures were made available last week in a statement to members of the Montreal City Council.

The poll was taken by a group of experts in this line of work.

The statement adds that a majority of both French and English-speaking residents were also under the impression that taxes on their light bills had been steadily increasing in recent years.

According to the statement, slightly more than 75 percent of persons consulted, both French and English speaking, were definitely against the Quebec government taking over the distribution of electrical service in Montreal.

Those who expressed themselves as opposed to the provincial government expropriating this service were asked for their reasons. Most of them replied that they were satisfied with things the way they were, and a good many added that they were afraid there would be too much politics mixed in with the electrical service and that rates would eventually work higher.

Vermont Joins Villages in Fight Against Dam

Residents of West River Valley joined by state of Vermont in declaring war against federal plans to build power dam — "On this issue we fight," declares Governor Wills

Residents of West River Valley, near Brattleboro, Vermont, were joined last week by the state of Vermont in declaring war against federal plans to build a flood control and power dam at West Dummerston which would inundate at least three ancient New England villages and inconvenience a score of other communities and thousands of persons.

State's Rights Issue

Turning what had been a local issue up until last week into a clash over state's rights against federal encroachment, Gov. William H. Wills declared, "On this issue we fight!"

"We believe that this law would destroy both our state and our statehood," the Governor continued, warning other states that unless the law is changed they will not "have any voice in determining what may be done within their borders." Governor Wills made it clear, however, that "Vermont wants to cooperate with the Connecticut River states and the federal government to assist the lower river states in obtaining relief from disastrous floods."

The issue dates back to 1938, when the flood-control act was amended to give the federal government the authority to build flood-control dams entirely with federal funds without the approval of the states. Before this amendment the law provided for joint partnership between the various states on interstate streams and the federal government.

Freemen, Inc., Organized

Last summer a group of Army engineers opened a sub-office in Brattleboro and began a detailed survey of the dam site at West Dummerston. Since then tempers among the residents have been rising and on November 12 they banded together as Freemen, Inc., with the avowed purpose of resisting "federal invasion."

Each of the seven villages which Freemen, Inc., contends will be destroyed held town meetings, Vermont style, and chose two delegates for the Freemen organization. Other delegates from nearby communities, including Brattleboro, a city of 11,000 population which serves the valley trading area, have since been added.

The threatened villages listed by the Freemen, Inc., are West Dummerston, Williamsville Station, Newfane, Harmonyville, Townshend, Brookline and West Townshend. Army engineers point out, however, that "studies to date indicate the villages of Newfane, Brookline, Townshend, East Jamaica and Jamaica are all located well above the maximum elevation of the flow line."

It is understood that two years will be required to develop detailed plans for the dam and no construction could be started until after the war. Vermont's Congressional delegation, however, hopes to block an appropriation for the dam's construction at the proper time, but it is feared that funds may turn up anyhow from a large blanket post-war projects fund.

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Seattle City Light Revenues Increase

Seattle City Light revenues showed a definite gain during November, according to report of Superintendent E. R. Hoffman, to the City Council. The utility showed a net income of $772,659 for November compared with $728,898 for November, 1942. Figures for the first eleven months of 1943 showed net income of $8,374,914, an increase of nearly 9 percent, or $690,700 over that for the same period in 1942.

However, operating expenses also increased in November, totaling $564,033, compared with $426,293 for November of 1942.

City Light customers climbed to an all-time high peak of 110,669 during the month, showing an increase of 1,823 over the number in that month of last year.

Electric ranges increased by 2021 to a new high of 55,188.

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Injunction Continued

Last week an order was filed in the federal court in Portland, Ore., continuing a preliminary injunction in the bankruptcy petition of the Portland Electric Power Co.

Permission to Use Fuel Oil for Power Revoked

Exceptions to Petroleum Distribution Order 13 permitting use of fuel oil for power generation in plants with coal standby facilities revoked — Oil on hand may be used up

Exceptions to Petroleum Distribution Order 13 which were allowed late in October to permit the use of fuel oil for power generation in Atlantic seaboard plants having coal standby facilities were revoked this week, halting further acquisition of fuel oil for this purpose. Oil on hand may be used up.

Priorities Revised

On the heels of this move, which saved thousands of tons of coal during November, December and thus far this month, came a revision by the Solid Fuels Administration for War of its coal "priorities" program under SFAW Order No. 10. The new program strikes hard at industrial users other than utilities by lowering allowable purchases by these users. While utility purchases are curtailed on paper, the new purchasing table is not expected to affect utilities materially since it will allow them about the same amount of coal as they actually were getting under the program enacted during November. (ELECTRICAL WORLD, November 20, 1943, page 3).

The new table is expected to free coal for retail dealers and thus ease shortages of fuel for domestic heating which have forced a growing number of diversion orders by SFAW recently. The table retains the differential between users who receive their coal by rail shipments and those whose coal is moved in whole or in part by tidewater.

Halting of oil supplies for power generation will require approximately 100,000 tons of coal monthly for the 15 to 20 companies which were switched to oil last October. The Office of War Utilities estimated that 400,000 tons of coal would be saved in the first quarter by use of oil, but savings already achieved this month and those which will result from continued use of oil by those plants having large supplies will total about 100,000 tons, lowering additional coal requirements to 300,000 tons through March.

It is anticipated that stockpiling of coal will be resumed at the close of the domestic heating season after April 1.

Coal Production Rises

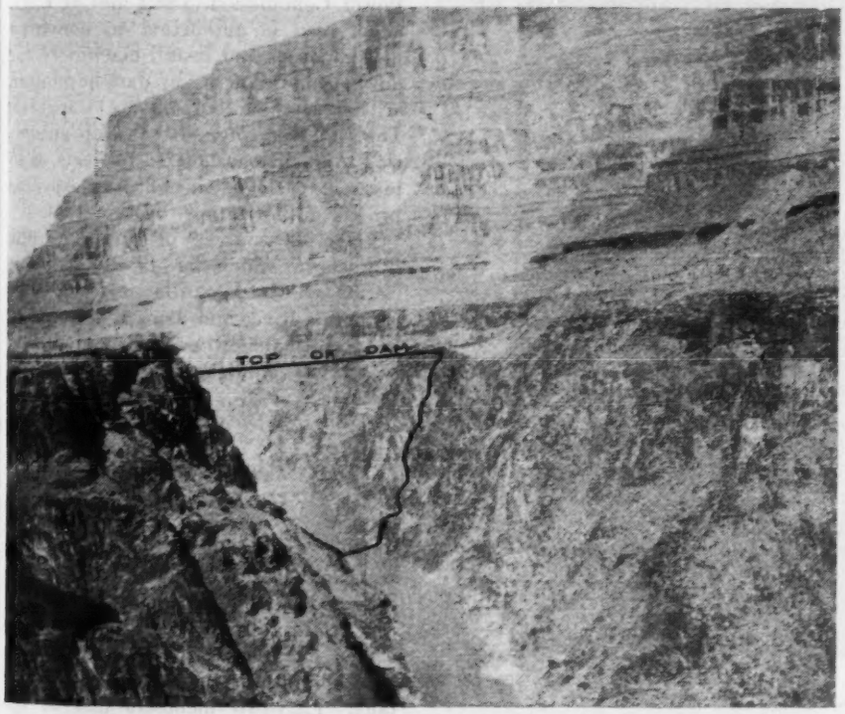
Meanwhile, coal production during the week ended January 8 rose to 12,230,000 tons from the holiday doldrums which for two successive weeks lost between 2,000,000 and 3,000,000 tons. Administrator Harold L. Ickes also ordered another large-scale diversion of bituminous coal to northeastern "anthracite states" to relieve the pressing shortage of domestic fuel.

Producers of high-voltile coal in the northern West Virginia fields were directed to fill all outstanding orders from all-rail retailers in Northeastern states during the first two working days of this week. Remainder of their domestic sizes mined on these working days was to be made available to SFA for emergency directives. Industrial coals not on order for retail dealers were not affected.

Solid fuels new coal purchase table follows: (rail—rail shipments; tidewater—tidewater shipments):

Percent of Monthly Burn	Utilities		Other Industrial Users	
No. of Days Supply	Rail	Tide-water	Rail	Tide-water
Less than 15	140	140	120	120
15-20	130	130	110	110
21-25	120	120	100	110
26-35	110	110	70	110
36-40	100	110	70	100
41-55	70	100	70	70
56-69	50	70	50	70
70-89	50	60	50	60

It is possible that coal users who have 90 days supply or more will not be allowed to purchase any coal unless they are unable to handle their monthly burn from their stockpiles. Such users would be allowed to order up to 50 percent of their monthly burn on filing an exception.



DAMSITE UNDER INVESTIGATION—View of the Bridge canyon damsite in Arizona, which is under investigation as a site for the development of an additional 800,000 hp. in electric energy from the Colorado River by a group of top-ranking engineers from the Los Angeles Department of Water and Power. The Bridge canyon damsite is located upstream from Boulder dam and has long been under consideration by engineers of the U. S. Bureau of Reclamation and other agencies for its power development possibilities. Engineering reports say that a dam rising 565 ft. above river level would create a reservoir with a storage capacity of 2,300,000 acre-feet

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Dam Project Opening

Power generation on the great Denison Dam, located on the Red River near Denison, Texas, is scheduled to begin March 1 if sufficient water can be stored in the meantime, United States Army Engineers announced last week. The $50,000,000 dam and power project is 93 percent completed and the main gates closed. An additional $5,000,000 will be spent on dikes and channels.

Third of Output for Electronics

Almost a third (32 percent) of the electrical energy output of Consolidated Edison Co. during the month of December was for electronic customers, according to John C. Parker, vice-president of the company, last week in answer to questions put to him before a Business Forum radio broadcast in New York.

Mr. Parker pointed out, however, that the figure for demand was lower (27 percent) and that some curtailment of the aluminum load during the month accounted for the figures making history rather than current fact.

Up to the year 1943 the biggest single load on the system of the Consolidated Edison Co. was used by the Independent Subway System's rectifiers, consuming 3,000 kw. each. Next largest load on the system in December was more than 100,000 kw. used by the Massena Aluminum plant, nearly 400 miles north of New York, Mr. Parker stated.

It was pointed out that more than 2,000,000 radio sets are in use in the company's territory, which are estimated to impose a demand of approximately 30,000 kw. on the system. On the subject of electronic devices, other than radios, Mr. Parker said that his company in December supplied more power for fluorescent lighting than for all the radio broadcasting and receiving sets in the city.

Power used in the average television set will be less than one-half kilowatt, according to Mr. Parker, and on the subject of future electronic uses, he said the fields of electrotherapy is now adopted and cooking will adopt electronic devices in the distant future.

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Corrosion Group Takes New Name

Six years ago an association of corrosion engineers was organized under the name of the Mid-Continent Protection Association. Purpose of the organization was the exchange of information regarding developments in the field of mitigation and prevention, by electrical means, of corrosion to pipe lines and other metallic structures. Other activities of the group were the promotion of co-operation between companies and the development of standard procedures and methods for use in connection with the work. The association has grown steadily and has attracted the attention of an increasing number of persons engaged in corrosion work.

Last week the expanded association was reorganized under a new name, National Association of Corrosion Engineers with headquarters at the Shell Pipe Line Corporation, Houston, Texas. An annual conference of the association will be held in the second week in April at Houston.

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Columbia Gas Holders Approve Pension Plan

It was announced last week by Stuart M. Crocker, president of Columbia Gas & Electric Corp., that the corporation had approved the pension plan for the system at a special meeting.

A total of 8,651,410 shares was represented, with 5,514,609 shares voted in favor of the plan and 3,087,237 against.

MEETINGS

Pennsylvania Electric Association—Electrical equipment committee, Roosevelt Hotel, Pittsburgh, Pa., February 10-11; A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md. Transmission and distribution committee, Benjamin Franklin Hotel, Philadelphia, Pa., February 10-11; M. M. Devorris, chairman, Pennsylvania Edison Co., Altoona, Pa.

American Society for Testing Materials—Symposium on plastics, Philadelphia, Pa., February 22-23. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Great Lakes Power Club — Winter meeting, Palmer House, Chicago, Ill., February 25. R. P. McClellan, secretary, Consumers Power Company, Grand Rapids, Mich.

Previously Listed

National Association of Purchasing Agents—Public Utility Buyers Group, mid-winter conference, Edgewater Beach Hotel, Chicago, Ill., January 24-25. M. B. Covell, chairman, Union Electric Company of Missouri, St. Louis, Mo.

American Institute of Electrical Engineers — National technical meeting, Engineering Societies Building, New York, N. Y. January 24-28. H. H. Henline, secretary, 33 West 39th Street, New York 18, N. Y.

Sales Executives Conference — Netherland Plaza Hotel, Cincinnati, Ohio, February 3-4. H. E. Dexter, secretary-treasurer, 50 Market Street, Poughkeepsie, N. Y.

Edison Electric Institute—Prime movers committee, Copley-Plaza Hotel, Boston, Mass., February 7-8; accident prevention committee, William Penn Hotel, Pittsburgh, Pa., February 11-12; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 14-15; transmission and distribution committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 14-15. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Society for Testing Materials—Spring meeting and committee week, Netherland Plaza Hotel, Cincinnati, Ohio, February 28-March 3. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Council of Electric Operating Companies—Annual meeting, Palmer House, Chicago, Ill., March 9. Tom P. Walker, president, Homer Bldg., 13th and F Sts. N. W., Washington 5, D. C.

North Central Electral Industries—Second war conference sponsored by electrical trade groups, St. Paul Hotel, St. Paul Minn., March 26-28. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

United Corp., which owns 2,410,856 shares and is the largest single stockholder, voted against the plan, Mr. Crocker said.

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Bill for Electric Plants Introduced

An omnibus rivers and harbors bill containing more than 200 projects (ELECTRICAL WORLD, November 27, 1943, page 59), eight of which make provision for the installation of facilities for hydro-electric power generation, has been introduced by Rep. J. J. Mansfield, Texas Democrat and rivers and harbors committee chairman.

The bill authorizes the projects but provides no funds for them. It provides that none of the projects shall be appropriated for or constructed until six months after the termination of the war unless such project is approved by the war agency concerned (generally WPB) and by the President.

In a departure from previous omnibus bills, Mansfield's measure provides that penstocks and similar facilities for power may be installed in any authorized dam when approved by the Secretary of War on recommendation of the Chief of Engineers and the Federal Power Commission. The Chief of Engineers also is authorized to construct power houses and install machinery for power generation at any dam heretofore or hereafter authorized by Congress. The Chief of Engineers is also authorized to modify authorized projects or to plan extensions beyond any specific project authorizations by Congress.

Principal sources of power in the projects for which the bill seeks authorization are the Umatilla project on the Columbia River and dams 1, 4, 7 and 10 on the Snake River between Pasco, Wash., and Lewiston, Idaho.

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Power Association Elects 1944 Officers

The Northwest Public Power Association recently unanimously endorsed Referendum 25 as a long step forward in the campaign for publicly owned electric light and water plants in Washington, Oregon, Idaho and Montana. Fifty-two members met in the City Light Building in Seattle and re-elected all its officers for 1944, as follows: President, Bert R. Lean, superintendent of Light, Cheney, Wash.; vice-president, J. W. McArthur, supt. of Water, Eugene, Ore.; secretary-treasurer, Eugene Hoffman, superintendent of Seattle City Light.

Output in Slight Decrease to 14.8%

The output curve took a slight fall for the week ended January 15, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,539,083,000 kw.-hr., as compared to the figure of 4,567,959,000 kw.-hr. for the week previous, which ended on January 8, 1944. Figures for the week, however, represented an increase of 14.8 percent over the 3,952,479,000 kw.-hr. distributed during the corresponding week a year ago. Figures for the similar week two years ago were lower, the total being only 3,450,468,000 kw.-hr. for that period.

Again, all of the major geographic regions of the country reported increases for the week over corresponding periods a year ago. The Pacific Coast region led the field with an individual gain of 29.9 percent. In second place, with a gain of 17.4 percent, was the Southern States region. The Mid-Atlantic region took third place with a gain of 14.5 percent. Low region for the week, with a gain of only 5.3 percent, was the New England region. The West Central region, which was in the last place last week with a gain of only 4.6 percent, increased for the current week to a gain of 6.4 percent. The Central Industrial region also showed an increase over the previous week with a gain of 10.3 percent.

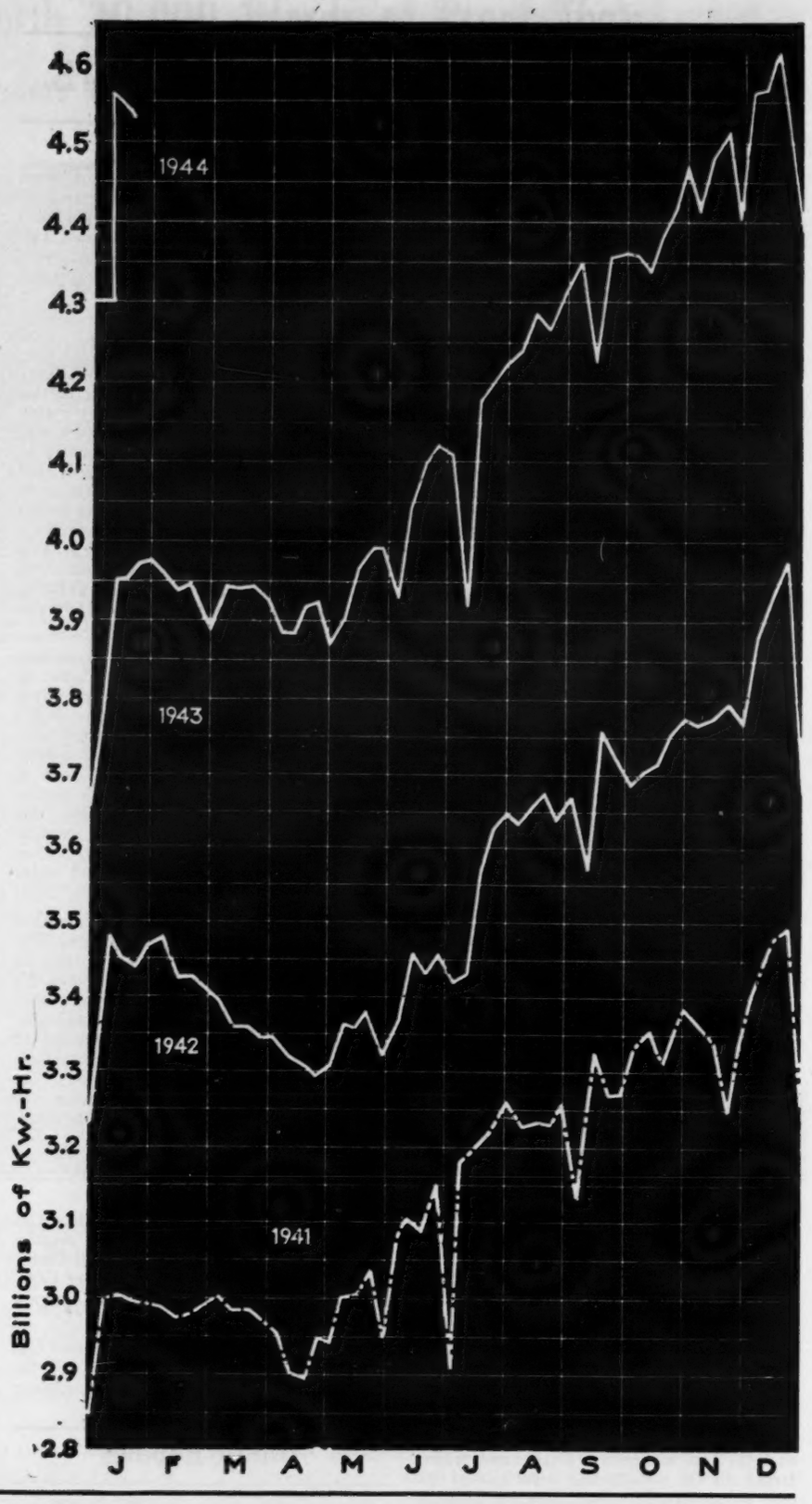
Weekly Output, Millions Kw.-Hr.

1944		1943		1942	
Jan. 15	4,539	Jan. 16	3,952	Jan. 17	3,450
Jan. 8	4,567	Jan. 9	3,952	Jan. 10	3,473
Jan. 1	4,300*	Jan. 2	3,780	Jan. 3	3,289
1943		**1942**		**1941**	
Dec. 25	4,295	Dec. 26	3,656	Dec. 27	3,234
Dec. 18	4,612	Dec. 19	3,975	Dec. 20	3,495
Dec. 11	4,566	Dec. 12	3,937	Dec. 13	3,475
Dec. 4	4,560	Dec. 5	3,883	Dec. 6	3,414
Nov. 27	4,403	Nov. 28	3,766	Nov. 29	3,339
Nov. 20	4,513	Nov. 21	3,795	Nov. 22	3,247
Nov. 13	4,482	Nov. 14	3,776	Nov. 15	3,348
Nov. 6	4,414*	Nov. 7	3,762	Nov. 8	3,368

Percent Change from Previous Year

	Week Ending		
	Jan. 15	Jan. 8	Jan. 1
New England	+ 5.3	+ 6.0	+ 5.0
Mid-Atlantic	+14.5	+16.1	+14.9
Central Industrial	+10.3	+ 8.3	+ 8.2
West Central	+ 6.4	+ 4.6	+ 5.9
Southern States	+17.4	+20.1	+18.8
Rocky Mountain	+12.8	+18.1	+15.4
Pacific Coast	+29.9	+32.9	+30.7
Total United States	+14.8	+15.9	+14.7

*Subject to revision.



ASA Approves Standard on Apparatus Bushings

The American Standards Association has approved, as an American standard, the Standards for Apparatus Bushings and Test Code for Apparatus Bushings (C76.1-1943), which was submitted by the American Institute of Electrical Engineers. There are two separate specifications in this publication: Standards for Apparatus Bushings, and (in the appendix), Test Code for Apparatus Bushings, which should prove of much value to the electrical industry.

The standard may be obtained from the American Standards Association, 29 West 39th Street, New York 18, N. Y.

Capacitators Installed

The first large-scale installation of capacitators on the Florida Power Corp. system has been made in the neighborhood of Lake Wales. A total of 2500 kw. in capacitators is being installed for improving power factor and eliminating reactive load.

SEC DECISIONS-HEARINGS

The Securities and Exchange Commission, in a series of orders issued last week affecting electric utility companies:

EXTENDED FOR ONE YEAR, beginning August 13, 1943, the period in which the trustees of Associated Gas & Electric Corp. may comply with an order for geographic integration under the Holding Company Act by disposing of 113 utilities, several trust companies and the New England Gas & Electric Association and its subsidiaries. The application of the trustees said that 58 companies had been sold, partial sales of two others had been effected and three had been eliminated by merger and consolidation since the date of the order, August 13, 1942.

ANNOUNCED THE APPROVAL by Judge Paul Leahy in the United States District Court at Wilmington, Del., of a plan of liquidation and dissolution of North American Gas & Electric Co. The plan, which also provides for the liquidation of a wholly owned subsidiary service company, Globe & Eames Co., Inc., had previously been approved by the commission. The court and the SEC held that there is no equity for stockholders of North American Gas & Electric Co.

PETITIONED THE SUPREME COURT for issuance of a writ of certiorari to review the judgment of the Circuit Court of Appeals for the District of Columbia last November 22, which reversed and remanded two orders entered by the commission on September 16 and October 6, 1942, in the Engineers Public Service Co. case. This is the first important case involving Section 11 (b) (1) of the Holding Company Act.

APPROVED THE PROPOSED MERGER of Southwestern Light & Power Co., into Public Service Co. of Oklahoma and certain related transactions between Middle West Corp., Central & Southwest Utilities Co., American Public Service Co. and West Texas Utilities Co. Among the transactions specifically approved were the issuance of 15,000 shares of 5 percent preferred stock by Public Service Co. of Oklahoma, the assumption of $6,648,000 principal amount of 3¾ percent first mortgage bonds of Southwestern by Public Service of Oklahoma and the issuance by the latter company of 11,167 shares of its $100 par value common stock.

GRANTED THE REQUEST of Iowa-Nebraska Light & Power Co. that it cease to be recognized as a holding company under the Public Utility Holding Co. Act of 1935. Last September 8 Iowa-Nebraska completed the sale of all its Iowa properties to Iowa Power & Light Co., a subsidiary of Continental Gas & Electric Corp., and transferred all the outstanding securities of its only subsidiary, Maryland Electric Light & Power Co., consisting of 4,000 shares of common stock and $340,000 of open account debt.

DENIED THE PETITION filed by Florida Power & Light Co. and its parent, American Power & Light Co., for a rehearing on certain conditions laid down by the commission recently in approving the proposed recapitalization of Florida. The commission on December 28 directed Florida to classify $1,815,655 in account number 107 and eliminate this amount from plant account by charge to earned surplus not later than December 31, 1944. The company also was directed to appropriate out of earned surplus a contingency reserve of at least $700,000 annually pending final determination of the amount.

Applications Filed

PROPOSAL OF THE Indiana & Michigan Electric Co. to reduce its common capital stock liability by $2,000,000 without changing the number of such shares now outstanding. The company is a subsidiary of American Gas & Electric Co., which owns all its common stock. Consummation of the proposed transaction, the company stated, will place it in a position to dispose of the amounts appearing to be recordable in account 107, electric plant adjustments, as finally determined by the regulatory authorities having jurisdiction over its system of accounts.

REQUEST OF THE Edison Illuminating Company of Easton, Pa., for permission to sell at market value $72,000 principal amount of the Lehigh Valley Transit Co.'s first mortgage bonds. The proceeds, with other funds, would be used to purchase from Edison's parent, National Power & Light Co., 4,317 shares of Edison's capital stock for $107,925. The application was made by Edison and National in compliance with the parent company's liquidation program under the SEC divestment order of May 23, 1941.

A JOINT DECLARATION by the Milwaukee Electric Railway & Transport Co. and Wisconsin Electric Power Co., both units in North American Co.'s holding company's system, covering the transport company's proposal to redeem on March 1 at par plus accrued interest, $200,000 face amount of its first mortgage bonds, and to purchase at par for retirement 8,000 shares of its capital stock, $100 par value, from the electric company, owner of all its outstanding securities.

Hearings Scheduled

JANUARY 24: Proposal of the United Gas the hearing set for this date at the request of counsel for the Niagara Hudson Power Corp. and Buffalo and Eastern Power Corp. on the plan of reorganization of the Niagara Hudson System.

JANUARY 24: Proposal of the United Gas Improvement Co., a subsidiary of the American Gas & Power Co., to change 35,000,000 authorized shares of no par value capital stock into 3,500,000 shares of $13.50 par value through an exchange of one new share for each ten of the present stock. Stockholders will vote on the proposed transactions at their annual meeting May 1.

JANUARY 24: Proposal of Bangor Gas Co., a subsidiary of American Gas & Power Co., which is in turn a subsidiary of Community Gas & Power Co., to reduce its outstanding capital stock from $600,000 par value to $480,000 par value and create a capital surplus in the amount of $120,000.

JANUARY 27: Combined hearings on a reorganization plan of the Federal Light & Traction Co. designed to consolidate its subsidiaries in Arizona, New Mexico and Colorado. Under the plan, Federal would secure a two-year loan of $1,000,000 with securities of Springfield Gas & Electric Co., Sheridan County (Wyoming) Electric Co. and Tucson Rapid Transit Co. offered as collateral. Proceeds from the sale of these properties would be used to reduce the loan.

FEBRUARY 1: Applications of the Virginia Electric & Power Co., the Engineers Public Service Co. and the Virginia Public Service Co., which includes an integration program involving acquisition of the last-named company by Virginia Electric & Power from the General Gas & Electric Co.

FEBRUARY 8: Proposal of the General Gas & Electric Corp. to sell to Warren W. W. Bell of New York, for $55,000 in cash, all of the outstanding shares (115,789) of common stock of Tide Water Power Co. of which Mr. Bell is a director.

Utility Reports

	Net Income 1943	1942
*American Gas & Electric and subs	$12,023,503	$11,462,638
*El Paso Electric (Texas)	612,313	512,829
*Gulf States Utilities	2,101,175	1,723,993
*Northwestern Electric	664,975	671,173
*Puget Sound Power & Light and subs	5,287,781	3,164,417
*Savannah Electric & Power	264,486	172,221
*Virginia Electric & Power	4,520,140	3,765,212

*Twelve months ended November 30.

Syndicate Offering Puerto Rico Bonds

Last week $10,200,000 Puerto Rico Water Resources Authority 2½ percent electric revenue bonds, due January 1, 1950 to 1969, were offered to the public by a banking syndicate headed by First Boston Corp. and B. J. Van Ingen & Co., at prices ranging from a 1.80 percent basis to par value.

The offering is part of a new issue of $20,000,000 underwritten by B. J. Van Ingen & Co., Kneeland & Co. and Barcus, Kindred & Co., who placed $9,800,000 privately, chiefly in Puerto Rico.

Purpose of the financing is to fund or retire $7,290,000 outstanding bonds, acquire Porto Rico Railway, Light & Power Co. and to provide funds for construction and reserves. The bonds are exempt from federal and state taxes and will be subject to redemption prior to the respective maturities.

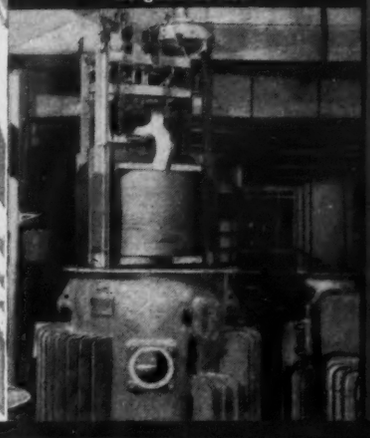
Missouri Utility Sold

The Sho-Me Power Co-operative, which is a combination of 29 REA-financed co-operatives of central, southeast and southern Missouri, has paid the Missouri Electric Power Co. $2,350,000 for its properties.

3 Pictures Worth 30,000 Words of Proof That:

"Pyranol transformers cannot burn or contribute to a fire"

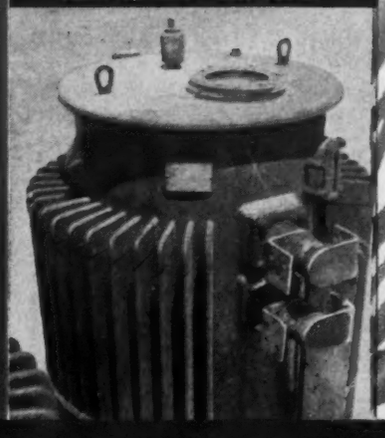
Core and coils were found as good as new



They stood up under fire

They came through a $50,000 fire virtually unharmed. Although surrounded by flame, they did not add to the fire.

Several bushings had to be replaced, and tanks repainted—that was all



ONE of the many benefits to be obtained from the installation of Pyranol* transformers was amply demonstrated recently when 12 Pyranol units were subjected to a severe external fire at a new war plant in the South.

From the field engineer's description of the fire, it is obvious that transformers without non-inflammable liquid, subjected to the same conditions, would have been almost a total loss. And it has been estimated that, with some types of transformers, the damage to the plant might have run as high as half a million dollars.

*Reg. U. S. Pat. Off.

The only reconditioning found necessary was the replacement of several bushing porcelains which were cracked by the heat, the painting of the tanks, and the addition of a small amount of new Pyranol to make up for that lost through the bushings.

The transformer interiors were in perfect condition. It was not even necessary to filter the Pyranol.

Here's an experience that proved the wisdom of investing in Pyranol transformers, from the standpoint of safety and reduction of losses from fire. *General Electric Company, Schenectady, N. Y.*

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

402-63-5100

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

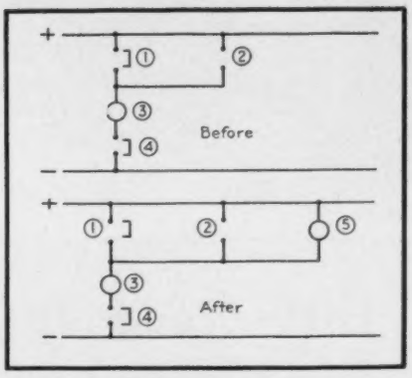
Bypasses Failure of Breaker Trip Circuit

By J. T. THWAITES
Section Engineer, Canadian Westinghouse Company, Ltd., Hamilton, Ont.

Trouble on a large industrial system made necessary immediate manual clearance of generating units on a section of the power station bus. The operator dashed along the board popping out the oil circuit breakers. But one breaker did not pop and that unit hung on, carrying about five times normal load. The bus section breaker, which acted as back-up to the machine breakers, did not open because the fault current did not exceed the normal load on it.

Investigation showed the reason for the failure of the one breaker to open. The auxiliary switch on the breaker mechanism, which in normal operation opens with the breaker and removes potential from the trip coil after it has done its work, was not making contact in the closed position —reason unknown. Thus, as is shown in the accompanying diagram, closing of the manual control switch did not energize the breaker trip coil, nor was its circuit closed by operation of the protective relays when the load on the unit went up high.

Provision against such failure in the future was made by installing no-voltage releases on the machine breakers as appears in the "before and after" diagrams. The NVR coil is connected across the control circuit in series with the auxiliary switch and the breaker trip coil and in parallel with the manual opening control and the protective relays. Now an open circuit in the auxiliary contacts on the breaker or in the trip coil itself will open the breaker forthwith, and



NO-VOLTAGE release guards against open in trip coil circuit: (1) manual trip switch, (2) protective relays, (3) breaker trip coil, (4) breaker auxiliary switch, (5) no-voltage release

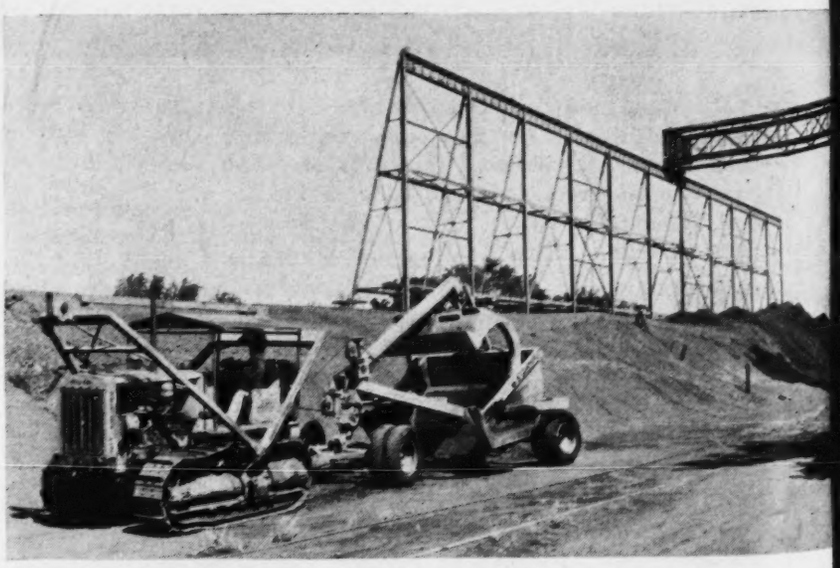
when the breaker is opened, either by the manual control or the protective relays, no one will ever know what bent the knee of the mechanism linkage—the no-voltage release because it was short-circuited and lost its potential, or the regular trip coil because it was energized. But that's a purely academic question, so long as the breaker goes out when it is required to.

•

Coal Pile Storage Increased Eight-fold

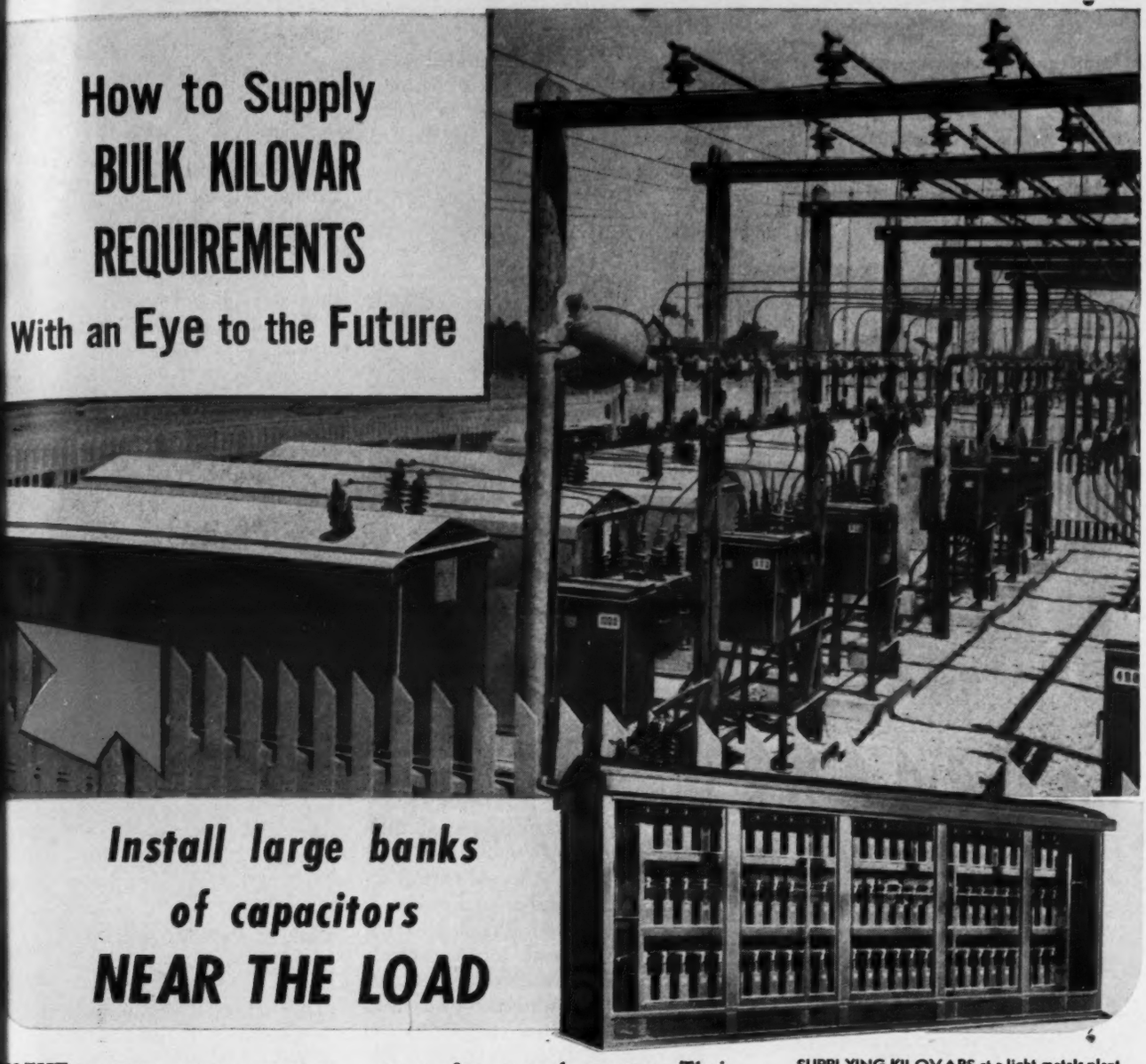
A change in the mechanical methods for storing and handling coal at Tulsa station of Public Service Company of Oklahoma has brought about an eight-fold increase in coal storage capacity at this station. This increase in coal storage capacity of 65,000 tons from an initial capacity of 8,000 now makes it possible to operate the station for six months using only stored coal.

Formerly the coal storage space at



TRACTOR and carryall scraper contribute to eight-fold increase in plant coal storage capacity; use of tractor compresses coal, cuts down on coal fires

How to Supply BULK KILOVAR REQUIREMENTS With an Eye to the Future



Install large banks of capacitors NEAR THE LOAD

SUPPLYING KILOVARS at a light-metals plant in the West—Pyranol capacitor equipments totaling 25,200 kva. Inset is a typical 2520-kva equipment, opened at the side to show 15-kva capacitor units and fuses.

N THE past two years a quarter of a million kva of large banks Pyranol* capacitors have been talled *near the load* to meet rtime demands for large blocks reactive kva. Why *near the load?* cause it has been found that, en the reactive requirement is plied by distant generators, it ot uncommon for approximately -third of the kilovars to be sumed in transit by the I^2X uired by the conductors and nsformers—not to mention the losses caused at the same e.

Capacitors are an ideal reactive source for several reasons. Their ready availability means that they can be obtained and installed in a matter of weeks. Their installed cost is well under $10 per kva. Relatively little critical material is needed in their manufacture as well as in their installation, compared with that required for additional circuit facilities.

A fact that adds immeasurably to the useful life of your investment is that, if future changes in system or load eliminate the need for the large bank, the capacitor units can be used later in smaller groups. G-E rack-type Pyranol capacitor equipments (for either outdoor or indoor installation) are ideal for this purpose.

Ask your G-E representative to estimate the benefits of large Pyranol capacitor banks on your system, or write for GEA-2746B. *General Electric, Schenectady, N.Y.*

. U. S. Pat. Off.

y week 192,000 G-E employees purchase more than a million dollars' worth of WAR BONDS

GENERAL ELECTRIC

407-71-5700

PYRANOL CAPACITORS

this station was an area 90 x 235 ft. immediately under an overhead crane way used to transfer coal from railroad cars to the storage pile or directly to the crusher house. Purchase of a 5-yd. front-discharging carryall scraper and caterpillar tractor combination has permitted extending the limits of the storage pile, at its two ends, beyond the overhead craneway.

Coal discharged from gondolas is now scooped up into the scraper, drawn to the ends of the previous storage pile and spread in thin layers over the expanded yard. Distributed in this manner the coal is packed down by the repeated passage of the tractor-scraper. As a result trouble formerly experienced with spontaneous combustion has now been completely eliminated. Some trouble with coal fires is still experienced in the area under the craneway. Here it is not practical to pack the coal with the tractor, since this would make it difficult to pick it up easily with the clamshell.

In spite of the addition of the carryall and tractor combination it was not possible to do away completely with the traveling crane, since it is still used to transfer coal from piles in the yard to bunkers in the crusher house.

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Adding Oil to Energized Bushings

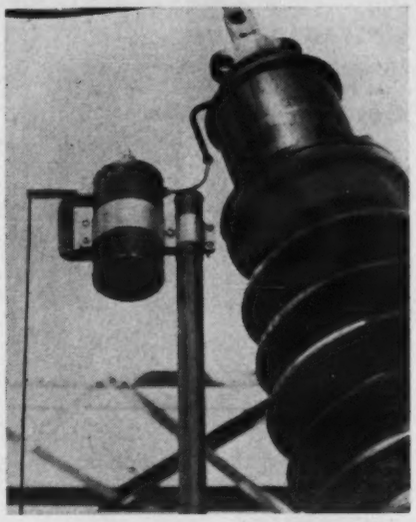
By H. B. COLBY
Electrical Engineer, Public Service Company of Colorado, Denver, Colo.

Adding oil to a high-voltage oil-filled bushing on a circuit breaker or transformer without removing the apparatus from service presented a problem that was solved recently by the Public Service Company of Colorado. The reason for filling without removal was due to a leaking bushing on a bank of transformers that supplies power to important war mining load.

This mine and mill operates on a 24-hour, 365-days-a-year basis and a short outage of only 30 minutes means many hours lost from a production standpoint.

After considering several methods of replacing the oil, a decision was made to inject oil under pressure into the bushing through the breather pipe.

A small pressure tank of about one quart capacity was salvaged from a liquid windshield cleaner on an old truck. It had a lever operated valve for releasing the oil, also a combination filling plug with an air valve. This tank, as shown in the illustration, was fitted with a clamp to mount on a switch stick. The nozzle for injecting the oil consists of a short piece of $\frac{1}{16}$-in. copper tubing reinforced with a piece of $\frac{3}{16}$-in. copper tubing and was bent upward. The small tube projected about 1 in. beyond the larger one so that it would extend up into the breather tube for a guide. A flange was soldered to the larger tube, which was the seat for a conical-shaped leather washer for seal. A paraffin treated cotton string was used to operate the release valve.



OIL IS ADDED to 110-kv. bushing

For the injection procedure the tank is filled with insulating oil to within 1 in. from the top, then air is pumped in to approximately 40-lb. pressure with a tire pump. The small tube is inserted into the bushing breather pipe and the leather gasket pressed firmly against the breather pipe opening. The cord attached to the release valve is pulled, and after about $\frac{1}{2}$ in. of oil has been added to the bushing the valve is turned off and the leather gasket backed off a little to allow the bushing to exhaust built-up air pressure. When exhausting, the small quantity of oil remaining in the breather tube is blown out.

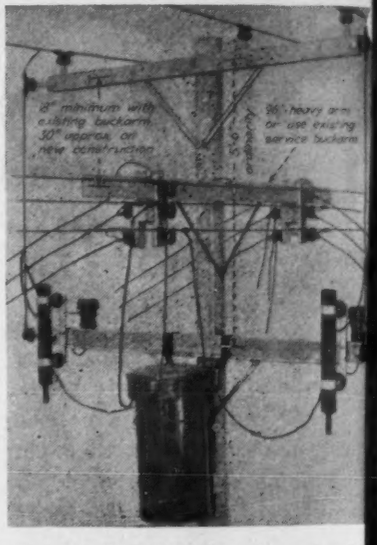
An experimental test was made on a 110-kv. oil circuit breaker which was energized and approximately $\frac{1}{2}$ in. of oil was added to the bushing in 20 seconds. This method of adding oil was considered 100 percent safe by the witnesses and the results were entirely satisfactory.

Model Photos Save Drafting Time

Use of models to study experi mental pole-top arrangements at th engineering division of the Detroi Edison Company pre-dates Pea Harbor. Recently, however, use of th technique has been extended to eas the load on draftsmen, who are scarc these days in Detroit as elsewhere.

Now the models—made to exact to 4 scale—are assembled to simulat standard pole top arrangements an photographed. Prints are retouche dimensioned and reproduced in th company's standard specifications fo overhead line construction in place the usual line drawings. The adva tages are twofold—the amount drafting is greatly reduced and th line crews have pictorial instructio for their work.

Ortho film is used in making th pictures; exposures are 40 seconds f 32, using a single 100-watt lamp the light source. The lamp is "wave

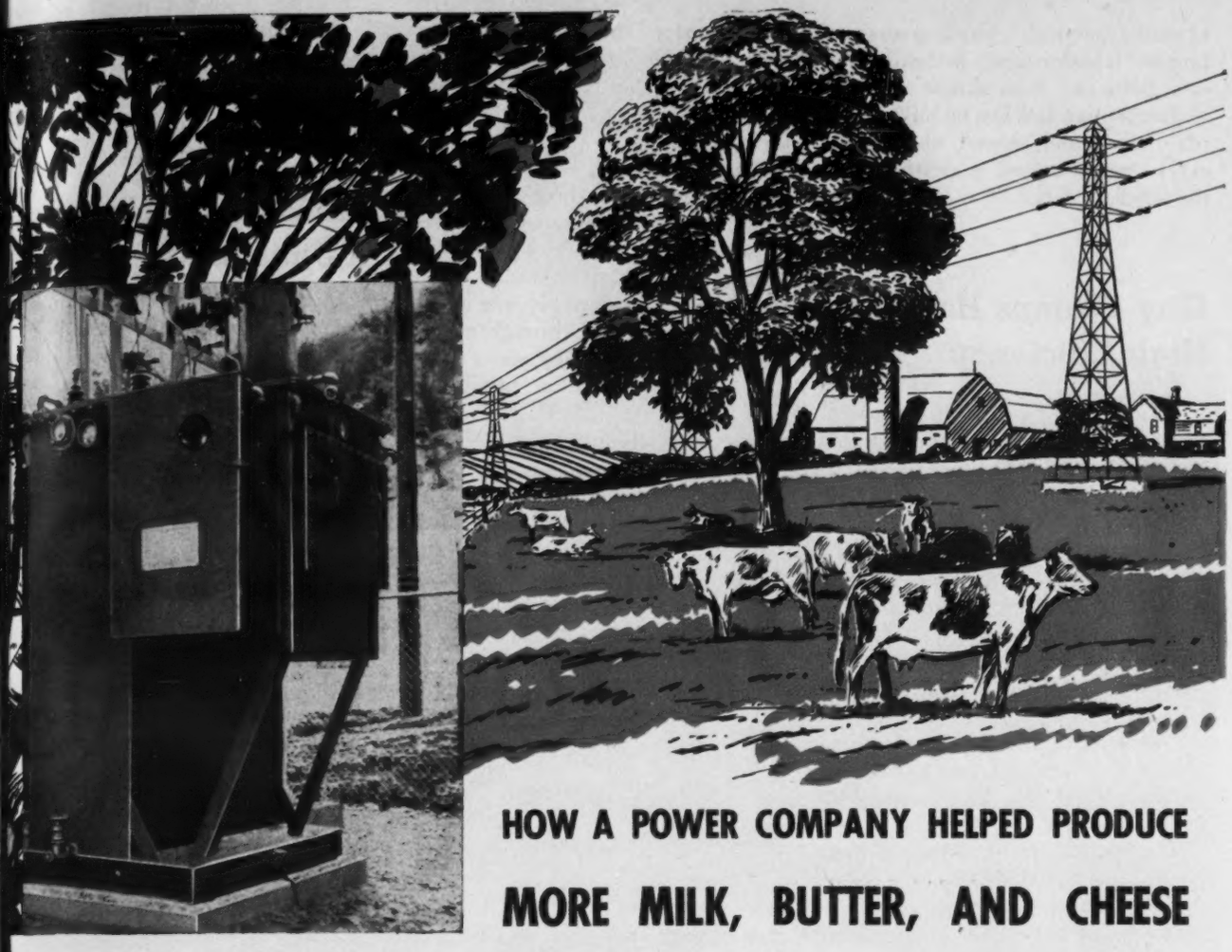


MODEL PHOTOGRAPHS dimensioned used instead of drawings in construct specifications

around" during the exposure peri to eliminate shadows.

Models are still used for the or inal purpose of working out spec problems in pole-top arrangeme Here, too, the models are time money savers. They avoid the need building a full-scale mock-up of s cial structures, thus saving crew ti and material required to build the Engineers and executives need longer go outside to see them.

By drawing on the extensive st



HOW A POWER COMPANY HELPED PRODUCE MORE MILK, BUTTER, AND CHEESE BY MEANS OF A *VOLTAGE REGULATOR*

OBLEM

A New York State power com-
y, serving one of the greatest
k producing counties in the
ited States, was faced with the
blem of supplying additional
er to dairy plants in this area. A
at increase in load had developed
ause of the additional electrified
ipment installed to meet the
rwhelming wartime demand for
k and milk products. This power
nand had to be met *in a hurry*
h little change in the power
npany's facilities, and with the
of as little critical material as
sible.

TION INCLUDED THE USE OF A G-E STEP REGULATOR

A standard G-E 300-kva, three-
se, 6900/12,000Y-volt step reg-
tor proved to be the key to the
tion. It was the only new equipment required to lick the problem. By redistributing the load among the substations supplying the area; by making use of a spare bank of transformers; and by correcting, by means of the step regulator, the poor regulation on a 6900-volt feeder, where peak loads persisted for six hours daily, it was possible to meet the new load demand *quickly* and without the necessity of new transmission facilities.

IF YOU NEED ADDITIONAL CAPACITY . . .

. . . better regulation may be your answer, too. Feeder regulators make possible more effective use of equipment on a system. Loads can be evenly distributed between substations or interchanged on tie lines; kilowatts, kilovars, and phase angle can all be controlled. Additional capacity can be released for new loads with huge savings in time, money, and critical materials.

Ask your G-E representative to estimate the benefits of feeder regulators on your system, or write for Bulletin GEA-2762. *General Electric Co., Schenectady, N. Y.*

FEEDER VOLTAGE REGULATORS

One of a series telling of wartime distribution problems being solved with G-E feeder voltage regulators — applications where they saved critical materials or otherwise helped the war effort, like some jobs you may have.

y week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

GENERAL ELECTRIC

of model materials—poles, crossarms, braces, transformers, potheads and even bolts and nuts, almost any kind of distribution line can be built on the office floor and moved about until every one concerned is satisfied with the smallest detail.

•

Guy Clamps Have High Efficiency

As a modified design of the typical Crosby clip and having an increased capacity provided by increased friction-grip area, a guy clamp has been developed consisting of three principal parts—(1) a separator provided with V-grooves on opposite faces to receive the load strand and the tail strand separately and providing a base for clamping purposes instead of pinching the strands together; (2) a U-bolt for clamping both strands and the separator, and (3) a clamping plate which is placed next to the load strand and fits over the threaded ends of the U-bolt.

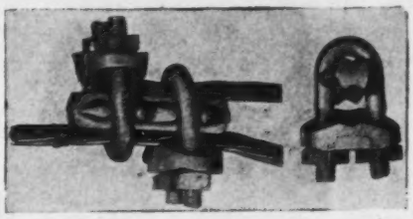
The clamps are of two types—one having a single U-bolt and a 2¼-in. long separator, fitting strands from ¼ to ½ in. inclusive; the other having two U-bolts and a 4-in. long separator, fitting strands $\frac{5}{16}$ to ½ in. inclusive. They are products of the Malleable Iron Fittings Company, Branford, Conn.

Capacity of these types of guy clamps is increased by an additional holding force exerted on the strand between the separator and clamping plate, created when an extra strain is put on the live leg of the strand. As the tension on the strand passes its elastic limit, tending to reduce its cross-section and the grip of the clamp on the strand, the bolt starts tilting, causing a wedging action, and automatically locks the clamp on the strand with a "come-along grip." The bolts are originally set at right angles to the strand and tilt at the threaded end in the direction of the applied load by pivoting on the lugs or trunnions provided on both sides of the separators; the clamping plate has a convex surface against which the nuts are seated.

Rating of the single-bolt clamp is set at 10,000 lb. ultimate and of the double-bolt clamp at 20,000 lb. ultimate. Each has a safety factor of more than 10 percent, according to the manufacturer. The clamps themselves have not failed in tests, except that they will not hold the strands without continual slipping if tested far above their rating.

Holding strength is based on tests in laboratories of three well-known strand manufacturers and of several operating electric utilities in addition to the manufacturer's tests. In the tests a dead-end assembly was used—loops were threaded through a thimble eye and the clamping plates placed in the leading position toward the load. The nuts were tightened to a torque of 80 lb.-ft.

Efficiency of the clamps is expressed as a ratio between the test strength with a given strand and the actual strength of that same strand tested between sockets into which strands have been secured with molten spelter. Efficiencies are based on the load at the time when one or more



GUY CLAMPS—(right) end view of single-bolt clamp; (left) double-bolt clamp following test to failure of ½-in. 7 x 6, 30 percent E.H.S. Copperweld strand (at top, edge of clamp)

wires of the strand broke. The failures (good tension breaks) occurred on the load side of the clamp and where the wires were scored by final setting of the clamp.

For the two-bolt clamp efficiencies ranged from 97 to 100 percent when attached to ⅜ and $\frac{5}{16}$-in., 7-wire, X.H.S. galvanized strand, and 97 percent when used with ½-in., 7 x 6, 30 percent E.H.S. Copperweld strand.

From tests made with two single-bolt clamps efficiencies were 96 to 99.5 percent when the clamps were attached to ⅜, $\frac{5}{16}$ and ¼-in., 7-wire X.H.S. galvanized strand.

When tested on ½-in., 30 percent E.H.S. Copperweld strand of considerably higher rating than one single-bolt clamp, the 10,000-lb. clamp did not slip until 11,700 lb. was reached. Wedging thereafter produced a grip, reaching a maximum of 16,700 lb. with continuous slipping; there was no mechanical failure of the clamp under this loading.

Departure of the U-bolts from the right-angle condition ranged from zero to 5 deg., indicating very little movement.

•

Ideas and Kinks from a Utility Shop—I

Ingenuity in meeting problems, principally by use of bits and pieces of discarded system equipment, can always be observed in electric utility apparatus repair shops. Here, for instance, are some things seen in the transformer and meter shops of the Birmingham (Alabama) Electric Company:

A machine for winding solenoid coils. Drive is through a pedal-operated friction clutch from the worm gear of an old induction regulator. The coil form is held between cone-shaped pieces, one permanently fixed on the driven shaft which is ½ in. in diameter and is threaded for most of its length. The other cone is screwed along the shaft and held by a lock nut as the length and diameter of the coil may require. A removable tail bearing allows the form to be slipped on the shaft.

A bench anvil whittled out of a chunk of 120-lb. rail with a cutting torch.

A portable substation mounted on an old truck chassis, the motor removed, but steering gear and brakes left intact.

A 20-gauge galvanized sheet metal cover for a portable oil filter. Tightly fitted, it is better weather protection than a tarpaulin.

The same kind of cover for the stationary press in the transformer shop, hung with cable and counter-weighted over a pulley so that it can be lifted easily and will remain suspended overhead when the press is in use.

A home-made float valve in the filter press so that when the oil in the surrounding tank reaches a determined level it is drawn off. This saves watching the tank to prevent overflow.

A rack for holding repaired bushing and lead assemblies for distribution transformers. The rack consists of a length of channel iron mounted horizontally on the wall and to which are bolted 36 rings which are based from old pellet-type lightning arresters. The bases are just the right size to hold the bushings.

"CONCENTRIC SCALE"

A 4¼-INCH SWITCHBOARD INSTRUMENT with a 6.8-inch scale

Made in a-c ammeters, voltmeters, single-phase and polyphase wattmeters, power-factor meters, synchroscopes, and frequency meters; d-c ammeters, voltmeters, and tachometer voltmeters; and temperature meters. Accuracy: 1 per cent.

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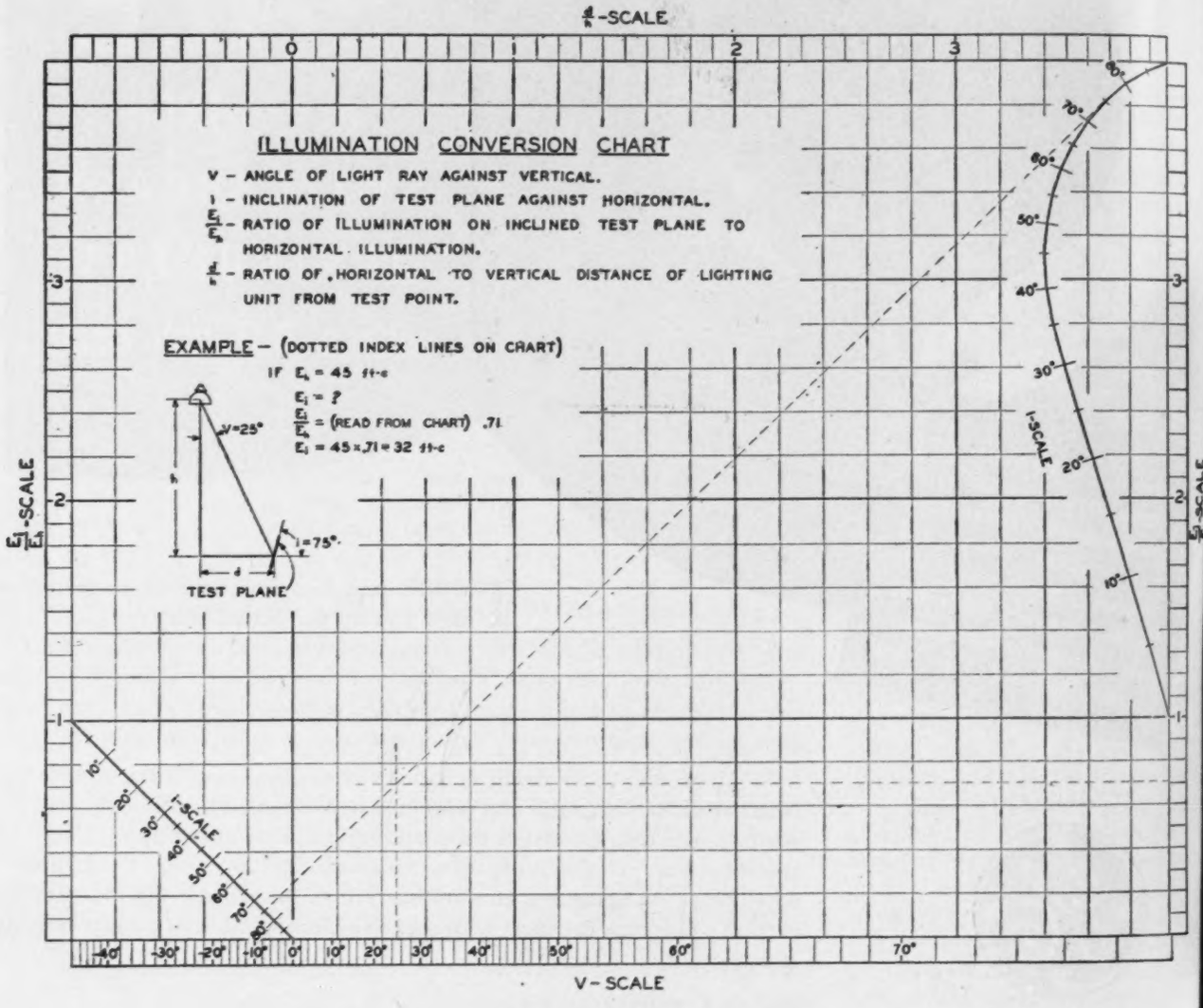
ILLUMINATION CONVERSION CHART

By KURT FRANCK, Manager, Engineering Department, Holophane Company, Newark, Ohio

A means for determining foot-candles on work planes at various angles against the horizontal when horizontal foot-candles, vertical and horizontal angles are known as well as vertical and horizontal distances of light unit from test point


d/h-SCALE
ILLUMINATION CONVERSION CHART
V – ANGLE OF LIGHT RAY AGAINST VERTICAL.
i – INCLINATION OF TEST PLANE AGAINST HORIZONTAL.
Ei/Eh – RATIO OF ILLUMINATION ON INCLINED TEST PLANE TO HORIZONTAL ILLUMINATION.
d/h – RATIO OF HORIZONTAL TO VERTICAL DISTANCE OF LIGHTING UNIT FROM TEST POINT.
EXAMPLE – (DOTTED INDEX LINES ON CHART)
IF Eh = 45 ft-c
Ei = ?
Ei/Eh = (READ FROM CHART) .71
Ei = 45 x .71 = 32 ft-c
V=25°
i=75°
TEST PLANE
Ei/Eh-SCALE
i-SCALE
V-SCALE

EXAMPLE

The work plane is inclined 75 deg. (*i*) against the horizontal and the light is coming from an angle of 25 deg. (*V*) against the vertical. The horizontal foot-candles (E_h) are 45. How much light is falling on the work plane?

Connect the 75 deg. points on the two obliquely placed *i* scales. Draw a line from 25 deg. on *V* scale and where it cuts the *i* line we get the $\frac{E_i}{E_h}$ value of 0.71. E_i then $= \frac{E_i}{E_h} \times 45 = 32$ foot-candles. The $\frac{d}{h}$ scale (tangent values) may be used instead of the *V* scale by finding the ratio of the horizontal and vertical distances of the light source from the working plane.

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How to Test Insulating Material*

4. Insulation Resistance Tests

By E. O. HAUSMAN
Continental-Diamond Fibre Company, Newark, Del.

A test method for an electrical property, known as electrical resistance, is frequently used for evaluating and classifying electrical insulating materials. The numerical value, expressed usually in megohms, is the ratio of the voltage applied to two electrodes to the total current flowing between the electrodes which are fastened, embedded or immersed in the insulating material.

With respect to the solid plastic insulating material which is the type treated in this discussion, the current that flows at a given voltage may consist of (1) that which flows through the surface layers and (2) that which flows through the volume of the material. The surface layer, commonly caused by moisture deposited on the material from the surrounding air, is that in which the resistivity is different from that of the body of the material. It is practically impossible to separate these resistance components, hence the measured resistance consists of a combination of surface and volume resistance.

Solid materials will absorb water in varying amounts from excessive for vulcanized fiber to nil for an aniline formaldehyde and other resins. With these materials, except some of the pure resins without filler, there is no true surface layer, since deposited water is absorbed into the material. If absorption does take place slowly, there may be a gradation of insulation resistance on passing from the surface to the interior. Such material lacks a true surface layer since change in resistivity is continuous.

Atmospheric conditions at time of measurement and the amount of conditioning the material may have had prior to measurement are highly important. Consequently the accuracy of control of those conditions is extremely important. The influence of moisture and temperature conditions will be discussed in some detail in later articles of this series.

The methods for measuring insulation resistance are described by the American Society for Testing Materials under designation D-257. Test specimen is a strip $2\frac{1}{2}$ in. wide by the thickness of the material. Length of the strip is sufficient to permit in-line mounting of at least six binding post electrodes which extend through the thickness of the specimen. Metal washers $\frac{9}{16}$ in. in diameter are held firmly in place by the binding posts in intimate contact with the surfaces of the test specimen. The path of measured resistance is $\frac{11}{16}$ in., the distance between the washers. Another path length may be used, in which case the measurement can be calculated in terms of that length, since the insulation resistance is practically proportional to the distance between the electrodes.

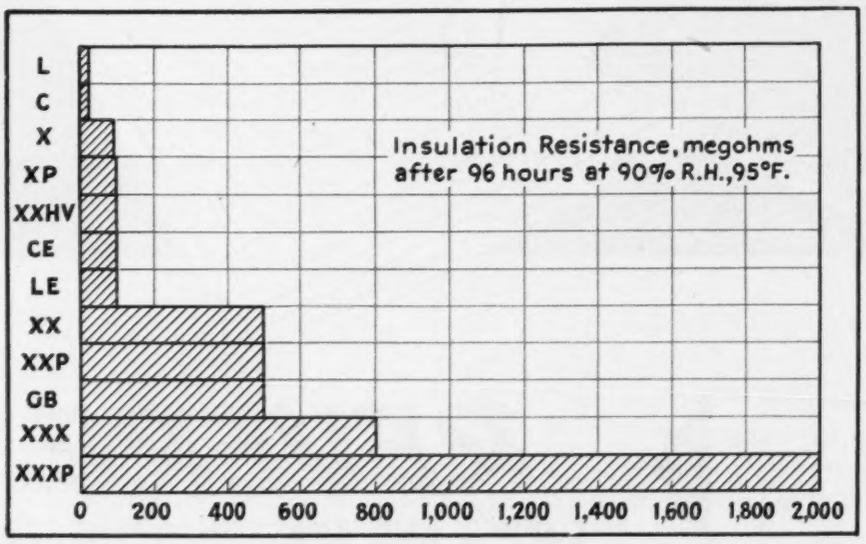
Measurements in the standard test are made at 225 volts d.c.; however, various d.c. potentials between 100 and 2,000 volts may be used. One form of measuring apparatus consists of a high-sensitivity galvanometer, an Ayrton shunt and a suitable calibrating resistance. Other modifications of the equipment are frequently used, such as a Megger and a more recently developed device known as a Megohm Bridge.

No standard conditioning procedure is specified in the standard method. However, a stipulation is made that the test specimen shall be kept for at least 96 hours at a definite humidity and temperature. One condition frequently used is 90 percent plus or minus 2 percent relative humidity at 95 deg. F. plus or minus 2 deg. Direct immersion of the test specimen in fresh water tends to produce very erratic results and poor reproducibility.

Average insulation resistance in megohms after 96 hours at 90 percent relative humidity and 95 deg. F. for some types and grades of insulating materials are:

Vulcanized fiber, 5; resin impregnated vulcanized fiber, 15; laminated phenolic plastic grade C, 25; grade XX, 500; grade XXXP, 2,000; molded phenolic plastic, 100; aniline-formaldehyde resin, 40,000; bonded mica splittings tapes, 5; molding plate, 150. These values serve to show a comparison of the materials tested.

*This series began in "Electrical World," December 11, 1943, issue.

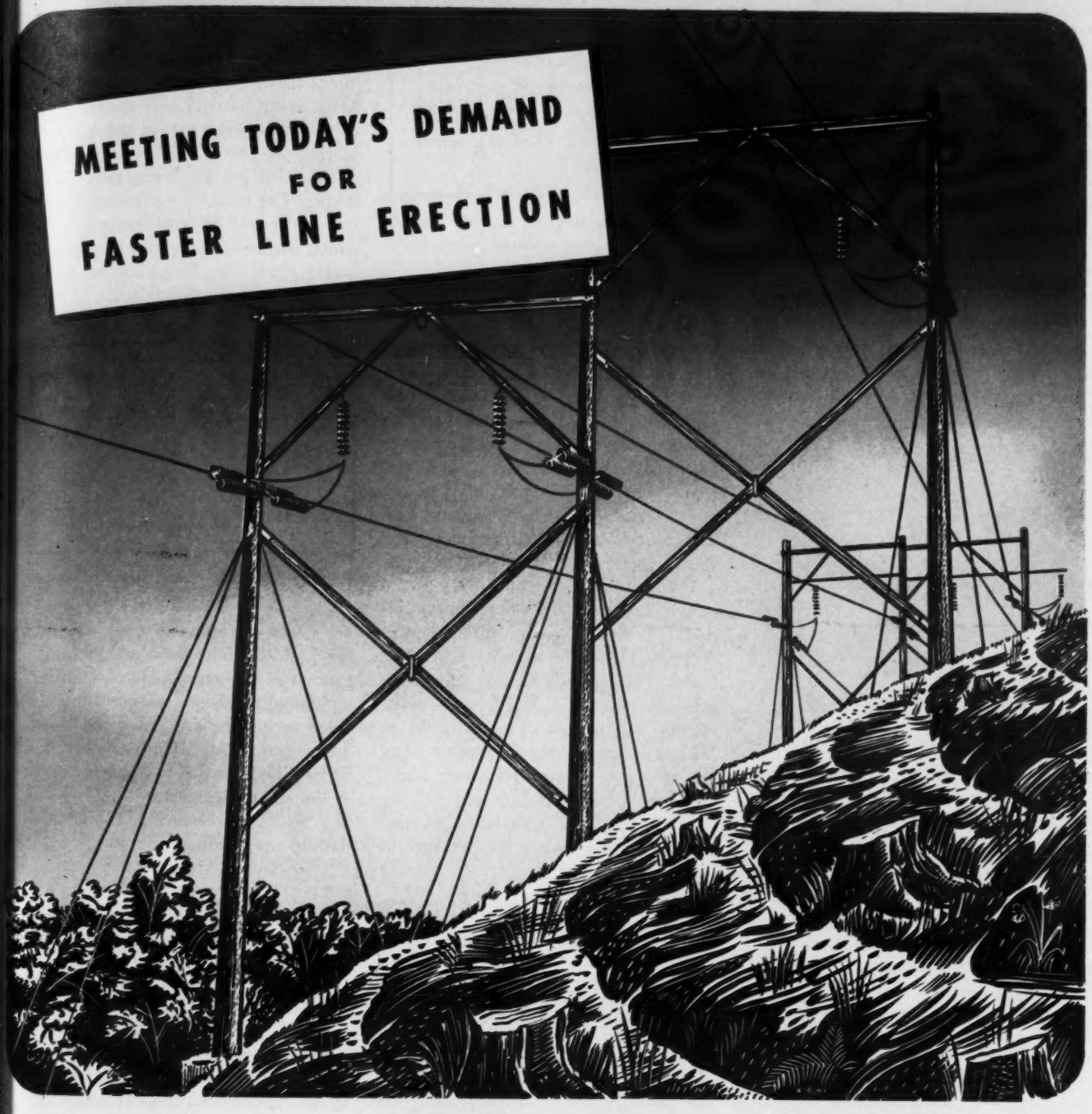


TYPICAL insulation resistance values for various grades of laminated phenolic insulations

Curtain Type Damper Saves Fuel

By J. E. O'BREEN
Managing Director
James Gordon & Co., Ltd., London, England

Greater economy in coal consumption is being obtained in existing plants in England and the United States by equipping them with a curtain type damper. This device (Fig. 1) consists of a large sheet of asbestos material (D), which in the open position of the damper is wound upon a roller by means of a winding gear (E) actuated either manually or by a motorized reducer. When closing, the weight of the roller (F) pulls the asbestos sheet down over seals located around the periphery of the duct. A steel checker frame (B) supports the curtain against the chimney suction. This Heacon damper is now being installed in the United States by the Thermix Engineering Company, Greenwich, Conn.



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ERECTION and MAINTENANCE OF TRANSMISSION LINES

NEW YORK **46 S. FIFTH ST., COLUMBUS, OHIO** CHICAGO

One of the applications is for shut-off when a boiler or complete boiler plant is closed down temporarily, such as during the night, and permitting a quick boiler pick-up in the morning. In such a case fuel can be conserved if the heat contained in the boiler at the moment the boiler is being banked could largely be kept there until the next morning. An example of the conservation is shown in Figs. 2 and 3.

The curtain type damper has been installed in a number of power stations. Following data were obtained on recent inspections of two installations near London; one being among

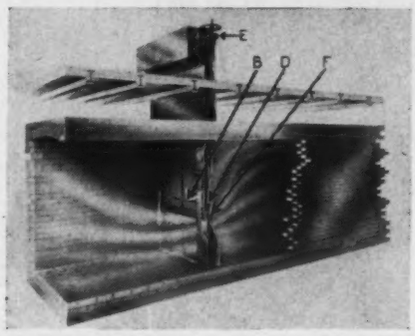

FIG. 1—Typical arrangement of curtain damper

the latest and most efficient plants in the country, the other a comparatively old and small peak-load station.

The large station referred to has four boilers, each having a normal evaporation of 300,000 pph. (with pulverized coal), steam pressure 650 psi., temperature 850 deg. F. These units are fired with pulverized coal (three mills per boiler) and they are equipped with economizers, air heaters and large dust collectors. The dampers are installed between the economizers and air heaters and have proved a complete success.

During the six hours the boilers were shut down the steam pressure fell from 650 to 560 psi. Tests have shown that when the improved damper is not used, but all other dampers are closed, the steam pressure falls from 650 to 150 psi. Thus the curtain damper saves per pound of water in the boiler 129 B.t.u. or with a water content of 110,000 lb. the saving is 14,190,000 B.t.u. On the basis of 85 percent over-all efficiency the equivalent coal saving is 1,669 lb. having a C.H. value of 10,000 B.t.u. This figure does not take into account the saving made by keeping the steel of the boiler and

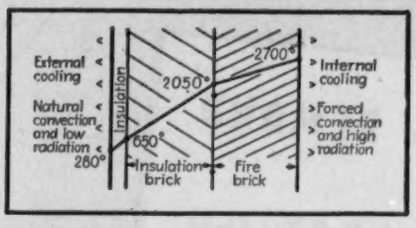

FIG. 2—Section through a brick furnace wall, showing temperatures when boiler is in operation

economizer at a higher temperature.

The second station is only running two out of three shifts and is completely shut down for six hours each night. In spite of this condition the thermal efficiency obtained compares favorably with older base load stations and the results are only just below the well-known Battersea and Fulham stations, which were completed shortly before the war.

During the operating period the station had three boilers steaming, all having a normal evaporation of 40,000 pph. One of these units, a Stirling boiler working at 200 psi. and delivering steam at 670 deg. F. with brick setting and arches, was equipped in May, 1940, with the improved damper at a cost of approximately $585. Previously between 280 and 310 lb. of coal per hour was being burned each night to keep the temperature of the brick-work up and prevent the steam pressure from dropping. Since May, 1940, the boiler is sealed off when being banked and has been left in this condition for as much as 24 hours, the drop in steam pressure during this period being only 70 to 80 psi. The total coal consumption of this station is 30,000 tons per year, which works out at about 30 tons per boiler day. As the banking losses amounted to about 3,000 lb. of coal

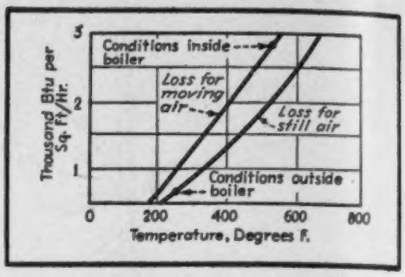

FIG. 3—Heat loss from hot surface to air

per night or, say, 1.3 tons, the saving in fuel amounts to as much as 4 percent of the coal previously burned.

Although this station has but a few years to run before it will be closed down completely, the dampers will be installed on the two other boilers at the earliest opportunity. They will pay for themselves in about three months operation.

• • •

Forming Plugs Aid Motor Coil Assembly

DESIGNER removing one of telescoping forming plugs from a core and coil assembly

A double forming fixture devised by Victoria Abbott, a forewoman at a General Electric plant, halved the time needed to assemble random-wound coils to the stator cores of small instrument-type motors and made the operation easy for new assemblers to master.

The core must be shaped and bound at its two sides. Previously, the coils on one side were packed around a forming plug, after which the plug was removed and inserted in the other side. Frequently the binding and shaping operation on the second side would force the turns on the first side out of shape. Operation depended largely on trial and error, difficult even for experienced operators.

Miss Abbott solved the difficulty simply by designing a pair of forming plugs which couple by telescoping inside the core, making it possible to shape and bind both sides before removing either plug.

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Any arrester might become damaged at some time in service. The L-M ISOLATOR will then save you time and money because it will automatically cut off the faulty arrester from the line, preventing feeder lock-out or phase grounding — Only L-M Arresters have the ISOLATOR. (Pat. 2,315,320).

Detailed information further explaining and illustrating these features and the reasons why they contribute to better service are fully covered in L-M Bulletin 40151. Write for it or ask your L-M representative for a copy.

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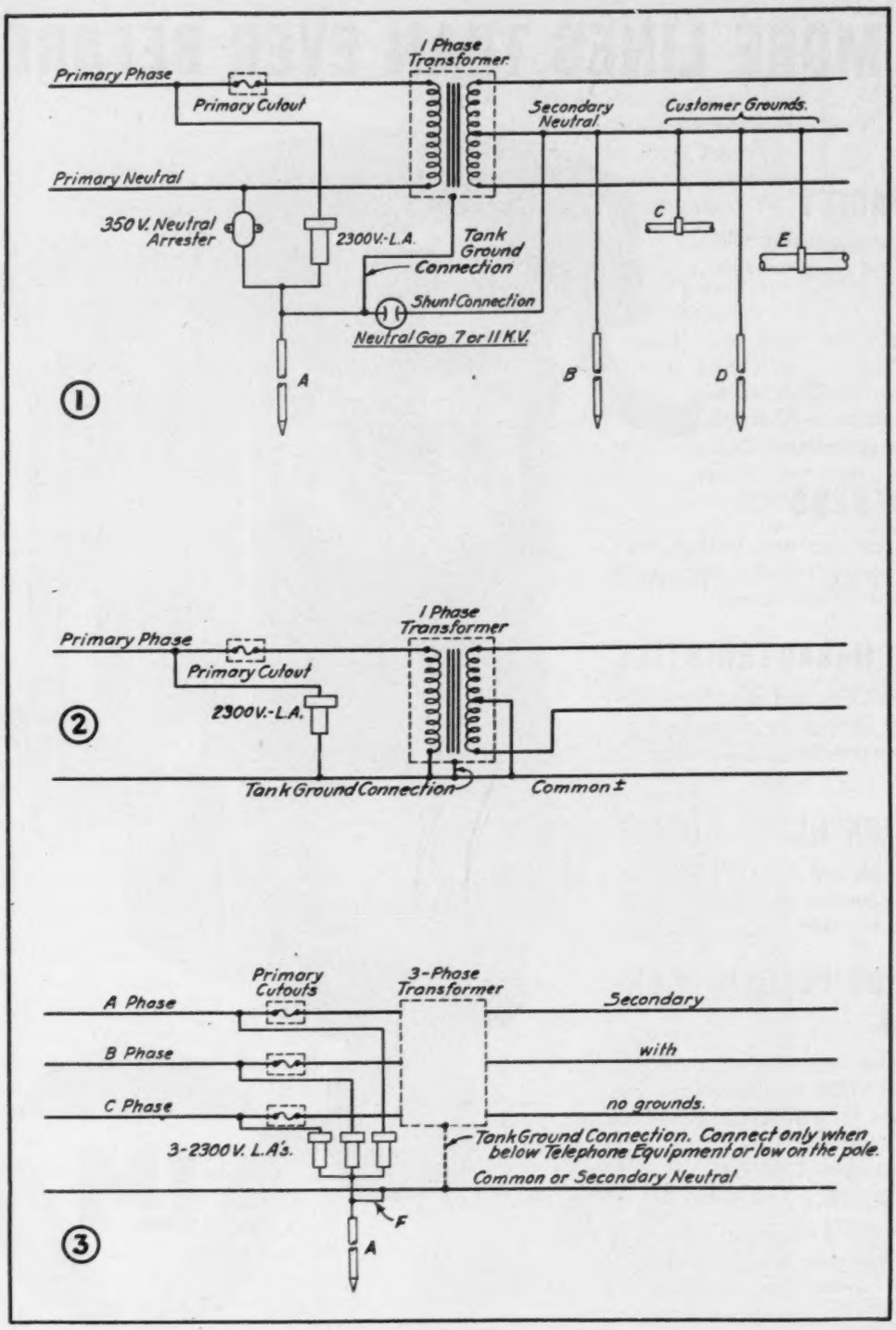

1. Single - Phase Transformer Without Common Neutral

A—8-ft. lightning arrester ground; to be used only when there are less than three grounds of type E.

B—Auxiliary 8-ft. ground rod at adjacent pole; to be used when there is no ground of type C, D or E. If necessary an added section of neutral must be run to establish this ground.

C—Private water systems ground.

D—Customer ground rod.

E—Town water system ground.

Neutral gap is to be used only when there is no ground of type E and only one ground of type B, C or D.

2. Single - Phase Transformers With Common Neutral

3. Three - Phase Transformers

A — Lightning arrester rod; to be used only when (1) there is no interconnection to a common or secondary neutral, or (2) interconnection is made to a common or secondary neutral having less than three grounds of type E.

F—This solid interconnection is to be omitted only when (1) the common or secondary neutral wire does not exist on the same pole as the transformer, or (2) when there is no secondary ground of type E and only one ground of type B, C or D.

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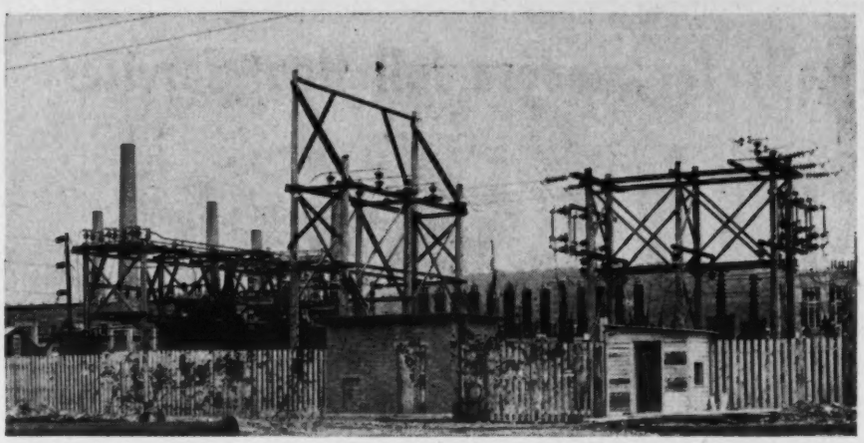


CONNECTION of rubber process plant to utility system through 66-kv. substation

Power Byproduct of Synthetic Rubber

By J. L. LAMBERGER
Manager Industrial Sales Department, Duquesne Light Company

The logic of power interchange arrangements between industrial plants and utility systems gains weight as synthetic rubber production takes its important place in the industrial life of the nation. An excellent example is the relation between the Kobuta plant of the Koppers Company near Pittsburgh and the Duquesne Light Company.

The Kobuta plant, comprised of four production units, the first of which went into operation June 30, last year, will have an annual output of 80,000 tons of butadiene and 37,500 tons of styrene. These are the end products of this plant and are shipped elsewhere to be combined into rubber. A large boiler installation is necessary to supply the tremendous amounts of steam used in the chemical processes of butadiene and styrene production, thus providing opportunity for generation of about 35,000 kw. electricity as a byproduct. The electrical load of the plant will total about 16,000 kw.; thus there will be a surplus of 19,000 kw. Negotiations are now being conducted for purchase by Duquesne Light of the excess kilowatt-hours thus represented.

The Kobuta turbo-generator is not expected to be in operation until early in 1944. In the meantime Duquesne Light is furnishing power for the Kobuta units as they are finished and go to work. The interim service, shown in the accompanying picture of the 66-kv. substation, will remain as an interchange and emergency supply connection. For construction of the plant Duquesne Light supplies about 1,500 kw. through another connection at 22 kv.

When the plant is completed and in full operation it will be staffed by approximately 1,000 employees. Since Kobuta is quite remote from existing residential districts and transportation is inadequate, the FPHA is now building a 300-family housing project near by. This project will be served by an extension from the Duquesne Light 22-kv. transmission system.

•

Portable School Trains Women

Women trained in the field are solving our labor problem on substation construction work in outlying areas, says M. C. McKay, engineer of station construction of Pacific Gas & Electric Company. Need for manpower became so great on two large substation construction jobs that the personnel department and construction department hit upon the idea of setting up a portable school on the site and encouraging wives of men already on the job to take a two-weeks basic training course and go to work as helpers.

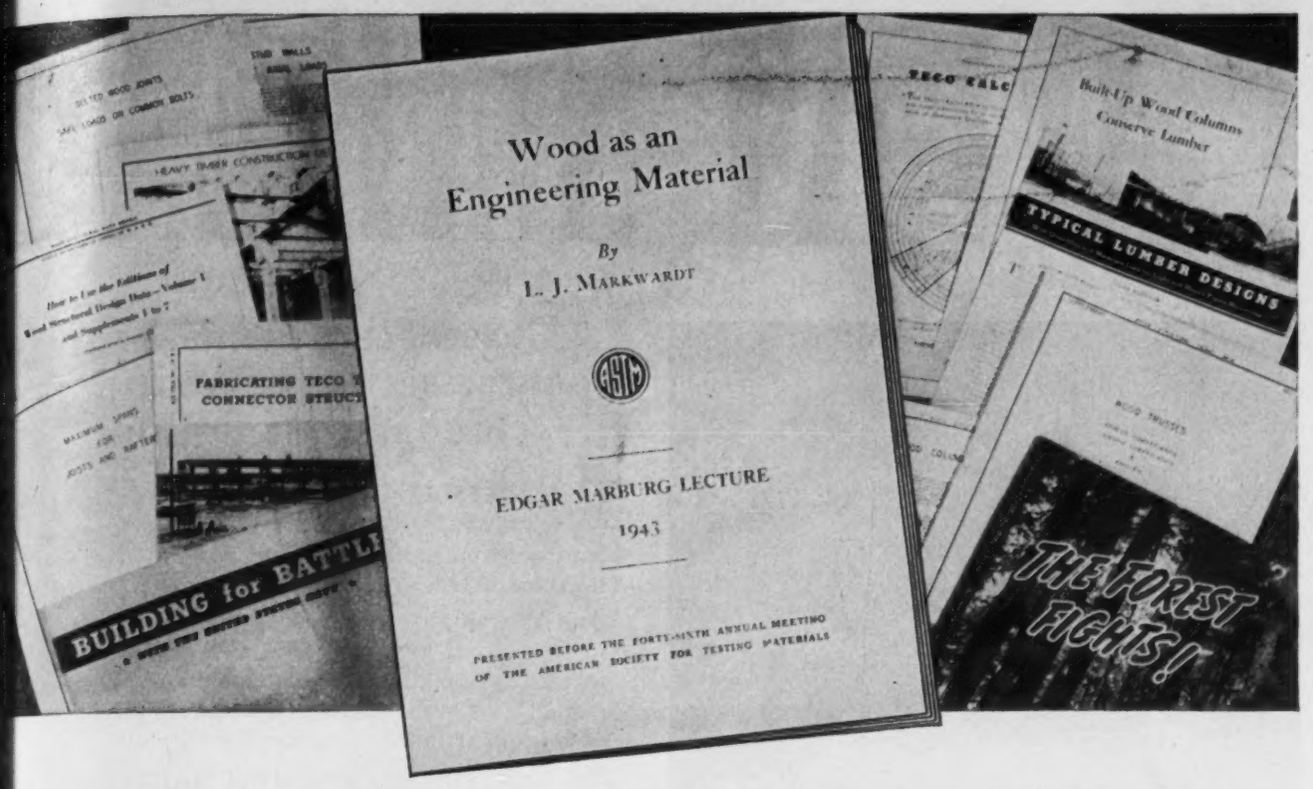
Wives of men on the job were particularly sought, since this immediately solved the transportation problem, the substations being located several miles from the nearest town. Schools were held in a tent set up with benches, vises, drill press, emery wheel, soldering irons, etc. The training course, which was handled by T. C. Fronmuller of the San Francisco main office, was of the strictly "how to do it" type. Students were paid helpers' scale during the training period and assured work at the same rating if they qualified. All women qualified at both schools.

Women helpers thus turned out have proved entirely satisfactory; in fact, according to several foremen, they are better workers and more dependable than the kids they have had working for them. Absenteeism has been practically nil and accident rate no greater than for men.

Just as a matter of prudence, women are not permitted to be helpers to their husbands. Quite a few of the women are wives of substation operators, several wives of linemen living nearby in house trailers are at work and others travel from their homes to the job.

So successful have proved the first two schools that several others are to follow. The tent and school equipment is quickly and easily loaded onto a truck and moved on to the next job.

IN THIS WAR VERSION of the country school women are trained to pinch-hit as helpers on substation construction work, performing their tasks equally as well as the men



BASIC TIMBER ENGINEERING DATA FOR ARCHITECTS AND ENGINEERS

"WOOD as an Engineering Material," by L. J. Markwardt, distinguished research authority of the U. S. Forest Products Laboratory, was presented at the invitation of the American Society for Testing Materials as the 1943 Edgar Marburg Lecture.

The purpose of this annual lecture is to present outstanding developments in the extension of knowledge of engineering materials.

In continuation of Teco's practice of making latest information on timber available to engineers and architects, copies of this lecture have been obtained and are available on request.

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WHAT'S AHEAD

G-E RESEARCH SCIENTISTS FORESEE THESE SIX IMPROVEMENTS IN FLUORESCENT LIGHTING

FLUORESCENT lighting has come a long way in the five years since General Electric first announced it to the American public and made the first installations at the New York and San Francisco World Fairs. And it's going still farther. As a result of G-E research in fluorescent for war needs, G-E research scientists foresee additional improvements that can and will be made . . . improvements that will help produce a vast new postwar lighting market for G-E Lamp agents.

No, these improvements aren't all ready now. G-E engineers and research scientists are busy with urgent war tasks. But they will be ready as soon as conditions permit . . . and meantime millions of G-E Mazda fluorescent lamps in American war plants are helping bring that time nearer faster.

3 **Improved color quality,** thanks to new and better phosphors developed by G-E research.

4 **The G-E Watch Dog Starter** is already here. Faster starting — much greater uniformity. No blinking when tubes burn out.

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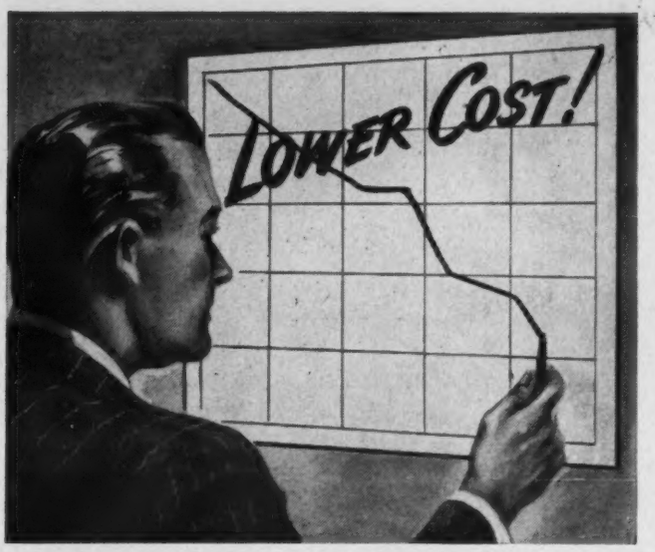
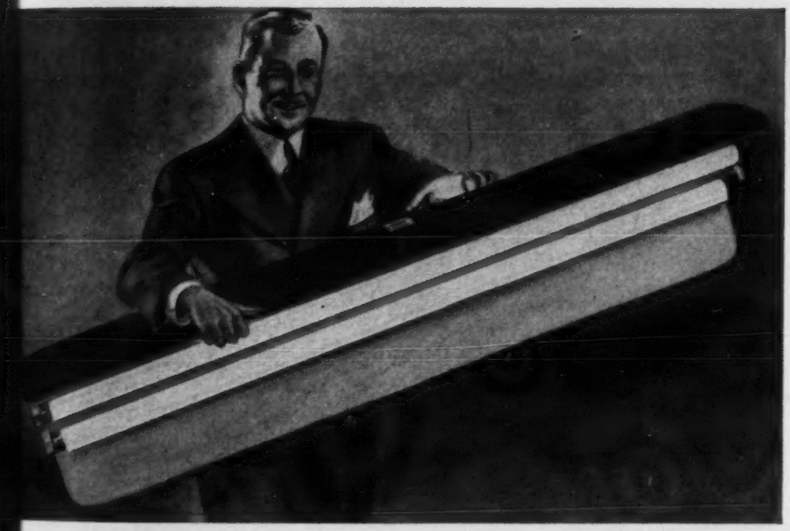


2 **Lower cost**—both on original installation and over a period of years.



5 **Better Fixtures**—more efficient and easier to install—through G-E's cooperation with fixture manufacturers.

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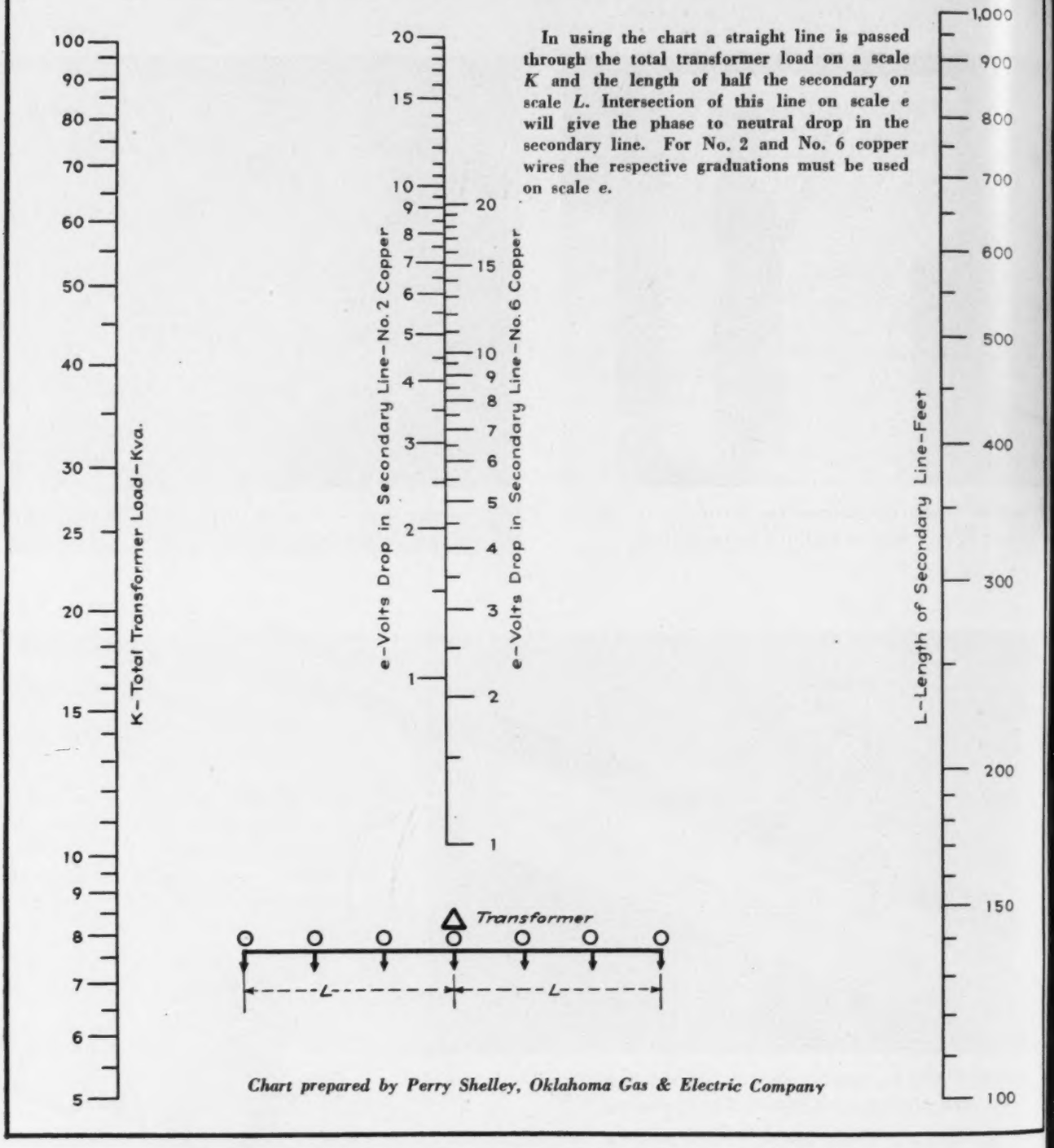
G-E MAZDA LAMPS

HOW TO DETERMINE VOLTAGE DROP FOR BALANCED SECONDARY LINE


K – Total Transformer Load – Kva.
e – Volts Drop in Secondary Line – No. 2 Copper
e – Volts Drop in Secondary Line – No. 6 Copper
L – Length of Secondary Line – Feet
Transformer
L
L

In using the chart a straight line is passed through the total transformer load on a scale K and the length of half the secondary on scale L. Intersection of this line on scale e will give the phase to neutral drop in the secondary line. For No. 2 and No. 6 copper wires the respective graduations must be used on scale e.

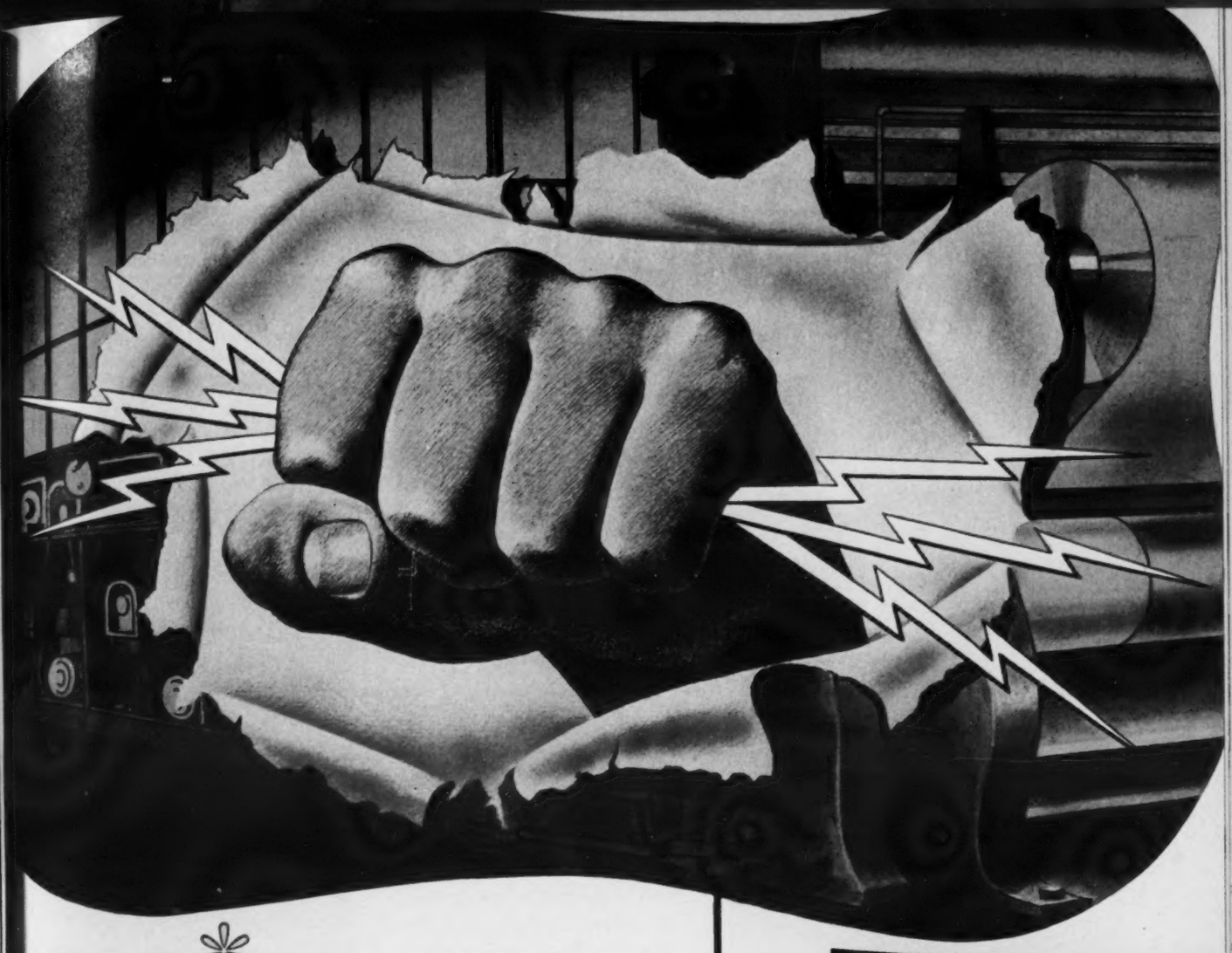
Chart prepared by Perry Shelley, Oklahoma Gas & Electric Company

Voltage drop from the center to one end of a secondary run, for the case where the transformer is located at the mid-point of the circuit and loads are assumed equal on each pole and balanced, is obtainable from this alignment chart. The chart applies for the case of a 120/240-volt, three-wire, single-phase secondary with either No. 2 or No. 6 copper wire on poles spaced 125 ft. apart.

Basic equation which the chart solves is:

$$e = K\left(\frac{zL^2 + 125zL}{960L + 60{,}000}\right)$$

where e = Voltage drop from phase to neutral at one end of run.
K = Total load on the transformer in kva.
L = Length of secondary from center to one end, in feet.
z = Impedance of wire, ohms per 1,000 ft.



O.S.* HOLDS POWER AT ITS PEAK IN PAPER MILL TURBINE

There's no lag in power at the Monroe Paper Products Company. The superior oxidation stability of Shell Turbo Oil sees to that. In fact, a sample drawn from this hard working turbine after 25,920 hours of continuous operation showed the ability of Shell Turbo Oil to *resist oxidation* to an unusual degree. It was as clear as the day it was put into the system! Moreover, in addition to its exceptional *oxidation stability,* Shell Turbo Oil also provides *protection against rust!*

Draw a sample of oil from your turbines. Compare it with the analyses of Shell Turbo Oil at right. Can the oil you now use match this performance?

For details on this and other outstanding performances of Shell Turbo Oil see the Shell man. Or, write Shell Oil Company, Inc., Dept. "H", 50 W. 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, California.

CERTIFIED PROOF OF THE SUPERIOR

*OXIDATION STABILITY

OF SHELL TURBO OIL

150-170	CHARACTERISTICS	168
Clear	Viscosity @ 100° F.	Clear
.05	Appearance	.05
.1	Neutralization No.	.2
	Saponification No.	

Performance record of Shell Turbo Oil in a unit of the Monroe Paper Products Co., Monroe, Mich.

SHELL TURBO OIL

Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil

SHELL

Another example of . . .

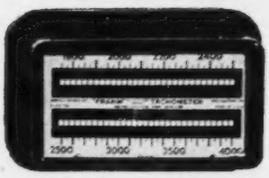
"FRAHM" LEADERSHIP

Special wide range "Frahm" frequency meter portable type.

One job we were recently asked to perform was a tough one; namely, to design and build a special wide range portable frequency meter that would indicate from 110 to 430 cycles per second. Furthermore, it was required that simultaneous readings be obtainable at 2 or more points on the scale. . . . The instrument shown above is the successful answer to this unusual problem.

MORAL: On Vibrating-Reed instruments, always look for the name "FRAHM" as a mark of leadership as well as excellence.

Frahm Vibrating-Reed Frequency Meters have long enjoyed wide acceptance. The principles on which they operate are so simple and their construction is so rugged that accuracy and long life are assured. Standard types, both portable and switchboard, are made in various ranges from 15 to as high as 500 cycles per second, with higher ranges under development. Write for Bulletin 1695-W.



"FRAHM" VIBRATING-REED TACHOMETERS . . .

Operate on the same unique principle as Frahm Frequency Meters except that reed vibration is produced by direct mechanical contact instead of electrically. Available in stationary and portable types . . . for use on turbines, generators, motors, blowers, centrifugal pumps, Diesel-electric installations, etc. Various ranges from 900 to 30,000 r.p.m. Write for Bulletin 1590-W.

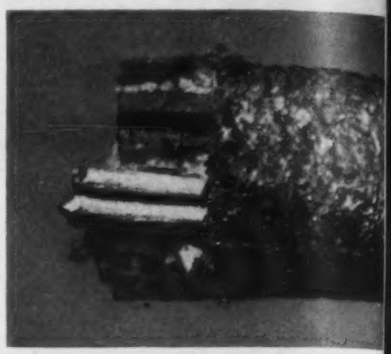
JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA 7, PA.

Lightning Flattens Two Cable Conductors

By BRUCE B. WATTS
Superintendent, Corning Municipal Utilities, Corning, Iowa

Result of a so-called lightning "freak" was the forcing together of the two No. 12 conductors in a non-metallic sheathed cable as shown in the illustrations. In this case the "freak" can be explained as the force exerted by a magnetic field created by a stroke of lightning.

The exhibit was taken from a 12-ft.



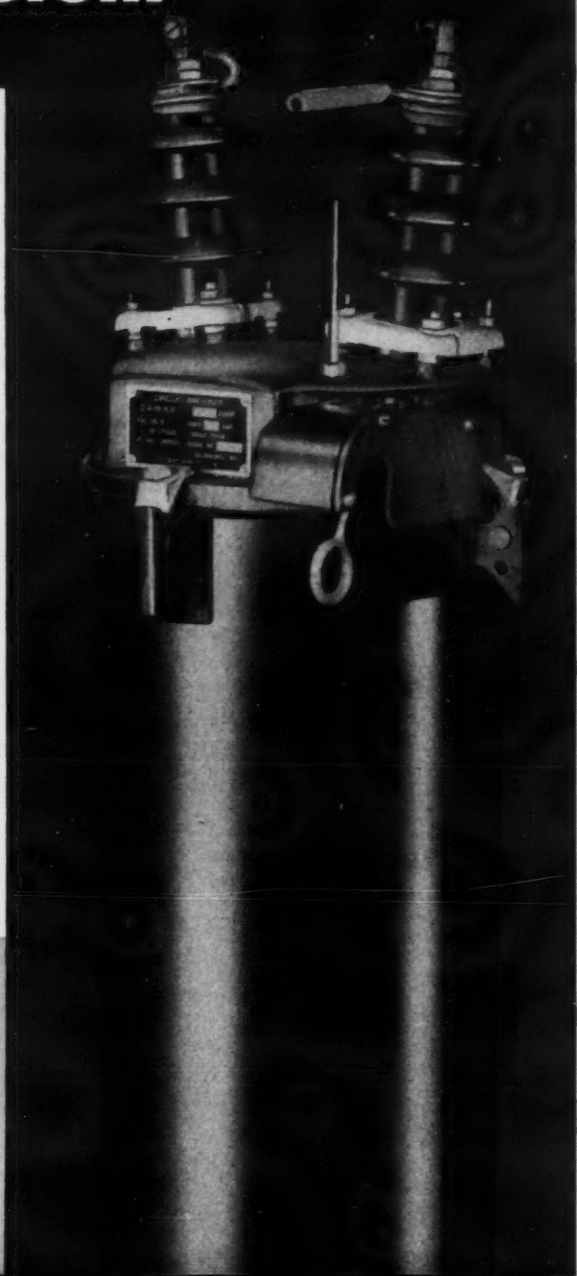
LIGHTNING FREAK: In a non-metallic sheathed cable one conductor was forced against the other (top), causing both to be flattened

length of cable in a farm wash house which is supplied by a multi-grounded REA system. The entire length of cable was found in this condition and it was the only damage done to the electrical system in the building, with the exception of a blown fuse.

By a close observation it was noticed that the "black" wire never moved for the full length of the cable. However, the "white" wire has cut through both insulations with such force that both conductors have been flattened.

YOU WILL SAVE

countless $450's by installing KYLE CIRCUIT BREAKERS at strategic locations in your distribution system



ery time your service truck makes a trip to replace a blown fuse, it costs 50 or more, depending on the distance traveled and the time involved.

th today's personnel problems, every unnecessary trip must be eliminated matter what the cost.

le Oil Circuit Breakers in your distribution system will eliminate 85% of se expensive service calls, save hours of labor and assure continuity of serv- Kyle Circuit Breakers do this by clearing all temporary faults . . . esti- ted at 85% . . . by their own automatic opening and hydraulic reclosing chanism.

le Circuit Breakers are easy to maintain. No motors or clockwork to get of order. Kyle Circuit Breakers are triple safe to install and operate . . . mal position of the breaker is open . . . operating handle and tank is always d . . . there is no terminal in the bottom of the tank. An automatic thermo- prevents damage to the breaker from overheating.

le Circuit Breakers are so designed that each opening is fast and each clos- requires an interval of three seconds. After the third opening, if the fault is in existence, the breaker opens for the fourth time and LOCKS OUT. n and then alone does it require manual operation for re-setting.

nk of what these Kyle dependable, automatic features can save . . . by ping your system in continuous trouble-free service.

Ratings of the Kyle Circuit Breaker
Volts: 2300 to 15,000; Amperes: 3 to 50; Minimum Tripping Current: 8 to 102 amperes; Interrupting Rating: 120 to 2000 amperes; Weight: 135 pounds with oil.

KYLE

Automatic Reclosing OIL CIRCUIT BREAKER

KYLE CORPORATION
SOUTH MILWAUKEE, WISCONSIN

Kyle Oil Circuit Breakers are sold exclusively th
d Representatives of the LINE MATERIAL CO

The "BIG 5" launches the 194

1 COMING YOUR WAY . . . IN MARCH!

ANOTHER "WARTIME SERVICE COLLEGE"

Featuring Repair and Care of G-E Electric Ranges and Water Heaters

Sitting-in at a General Electric Service Training School is one of the best investments any appliance service man can make. Coming your way in March is another in the series of meetings to keep you up-to-the-minute on wartime service and repair of G-E appliances.

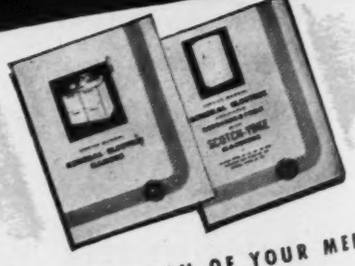
RANGES AND WATER HEATERS FEATURED . . .
Interesting movies, slide films and demonstrations have been arranged to fill you chock-full of information about oven calibrations and adjustments, plus cooking unit repairs and tips on how to handle customer complaints. *And don't forget, a complete new manual on G-E Range servicing will be ready for you.*

AND REFRIGERATORS . . .
Including introduction of the FEA sealed refrigerator unit designed to replace many of the older monitor top models.

1944 PLANS REVEALED . . .
Including General Electric's advertising and service promotion plans for 1944. Just because General Electric isn't manufacturing electric appliances during wartime, don't think G-E is allowing the public to lose touch! You'll hear what General Electric is doing to help dealers maintain their place in the appliance limelight.

AND THE FUTURE . . .
The future possibilities in the electric appliance industry will be discussed. Representatives of the General Electric Company will be there to talk about post-war sales potentials.

TWO NEW SERVICE MANUALS FOR YOU . . .
One on G-E Ranges; the other on G-E Refrigerators with Scotch-Yoke machines. The finest and most complete yet compiled. Get them at the March schools!



PHONE OR SEE YOUR G-E DISTRIBUTOR FOR DATE AND LOCATION OF YOUR MEETING

★ BUY WAR BONDS ★

Hear the General Electric radio programs: The G-E "All-Girl Orchestra" Sunday 10 p. m. — E. W. T. NBC. "The World Today" news every weekday 6:45 p.m.—E.W.T. CBS

G-E appliance service program

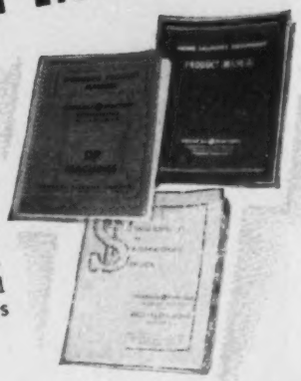
2

THER GREAT "T" PLAN HOME STUDY COURSE!

he "T" Plan on G-E Re-
igerators was so enthusi-
stically received by more
han 4000 General Electric
servicing dealers that we
now announce the second
step in our home study
program. This new com-
plete course will feature
G-E Ranges . . . You can
get ready now by making
sure you subscribe to the
"PRODUCT MAN", the
monthly product service
magazine. Ask your G-E dis-
tributor for more details.

3

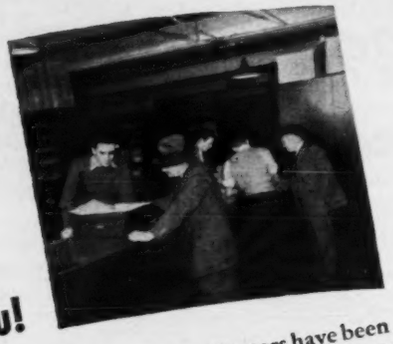
A COMPLETE SERVICE INFORMATION LIBRARY



G-E servicing dealers have always been fortunate in having at their fingertips good printed information on the repair of G-E appliances, such as the Appliance Service Handbook . . . . . the monthly "Product Man" . . . . and manuals. The new manuals on refrigerators and ranges help complete this reference library.

4

G-E APPLIANCE SERVICE CENTERS To Serve You!



G-E factory-operated Appliance Service Centers have been organized to improve the flow of replacement parts to dealers, distributors, and utilities. They can help make repairs your shop is not qualified to make. They can help train manpower. They will counsel with you on any problem that has to do with you servicing, priorities, etc. Start 1944 by getting acquainted with the things the G-E SERVICE CENTERS can do for you!

AUTHORIZED GENERAL ELECTRIC APPLIANCE SERVICE CENTER

5

G-E PARTS AND REPLACEMENT UNITS

Thanks to the cooperation of the U.S. government and the appliance industry, the replacement parts situation for 1944 looks bright. Get the detailed story at the March meetings . . . . and see:

1. The new FEA sealed replacement unit for Monitor Top models.
2. The new Duracast Calrod Unit for the replacement of surface units on G-E Ranges.
3. The new thermostat for older G-E irons.

MANUFACTURER · WHOLESALER · CONTROLLED · INSTALLATION · DEALER — Electric Servants

BETTER CARE LESS REPAIR

GENERAL ELECTRIC

Cooperate with your industry in its government approved 1944 National Appliance Conservation Program. Display the slogan!

THE GIANT OF MILITARY RADIO

The Army's SCR-299 Communications Unit!

As beachheads and command posts are established, the SCR-299 built by Hallicrafters speeds ashore and immediately starts operation in voice and code, while stationary or speeding through woods and along rough roads under enemy fire.

Today these Giants of Military Radio are repeating this tough job, with the Allied Nations, on all the battlefronts of the world. Whether directing the fire of battle wagons lying offshore or the concentration of Allied land forces' fire on a strategic hill, the SCR-299 "gets the information through!"

HALLICRAFTERS HAS THE HONOR OF BEING THE FIRST EXCLUSIVE RADIO MANUFACTURER TO RECEIVE THE ARMY-NAVY PRODUCTION AWARD FOR THE THIRD TIME! THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF SHORT WAVE RADIO COMMUNICATIONS EQUIPMENT

BUY MORE BONDS!

hallicrafters

Bench Fixture for Tying Stator Coils

By J. McMAHON
Assistant Foreman, Westinghouse Electric & Manufacturing Company, East Springfield, Mass.

A simple bench fixture has been built for use in tying stator coils securely with twine. Because of the limited amount of space available, it is not possible to use chicken or other metal bands. Therefore, a hand-tying operation is required on these small coils.

The stator is held securely in a vise, which is tightened and loosened by means of a quick-acting cam. When the cam is released the vise is opened by spring action, so that the stator is easily removed and replaced by another.

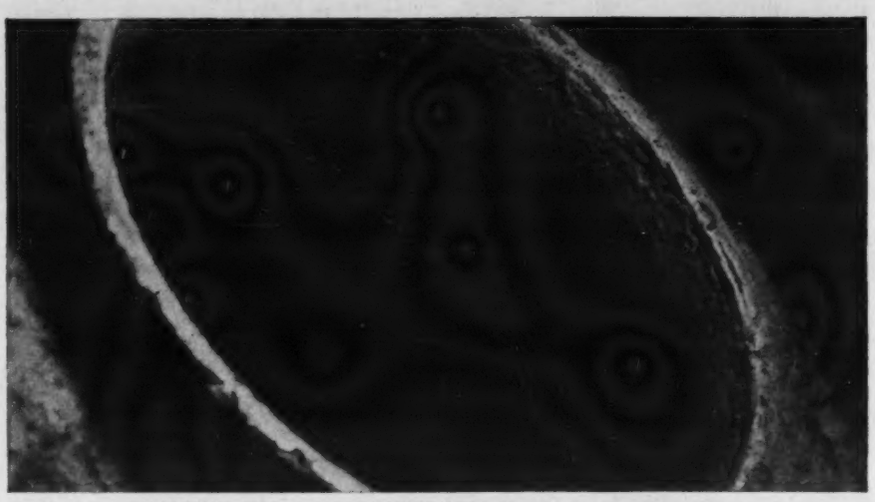
FIXTURE holds stator coil to be tied; overhead metal finger is in lowered position to hold half-knot tight

The operator inserts the twine in the proper location and makes a half-knot. Then the overhead metal finger is lowered by means of the foot treadle and holds the half-knot tight so that the operator can complete the knot. A spring raises the metal finger when foot pressure is released. The fixture and general set-up are so made as to require no hand holding of any parts, leaving the operator's both hands free for tying the knot.

It will be noticed that the fixture is mounted at bench height, enabling the operator to use a tool for maxi-

"Worn-Out" Boilers Work Thousands of Hours Overtime

As long as they pass inspection and hydrostatic test, APEXIOR keeps them in service for years —often many years — longer



Old Tube (enlarged) APEXIORIZED to prevent further wear

In thousands of war plants, utilities, railroads and ships today, you will find old, "worn-out" boilers sturdily delivering top ratings — "veterans" in war service that might have been condemned without the simple APEXIOR protective coating method of water proofing boiler metal and keeping it safe and on the job.

You, too, can solve the problem of boiler maintenance and continued availability in the face of increased power demands by applying APEXIOR to any boiler that can pass inspection and the required hydrostatic test.

If you have a boiler that is headed for reduced pressure or the scrap pile, treat it like this: (1) give it the required inspection and hydrostatic test; if acceptable, (2) clean down to bare metal — maybe it is in better condition than you think; (3) apply APEXIOR with a brush, by hand or power-coater.

How APEXIOR Keeps Boilers in Good Condition

You'll find APEXIOR provides a durable, water-resistant, corrosion-proof coating that seeps into the very "pores" of the metal. This wearing surface makes your boilers last longer — generally years longer, if maintained by re-applying a single coat once in 2 or 3 years.

You'll find APEXIOR prevents the direct bonding of dirt and scale to boiler metal. This makes your boilers easier to clean with a wire brush, and the APEXIOR surface is easily renewed when too thin for complete protection.

It's *available* — we have geared up our production to the metal shortages. It's *economical* — let us quote you facts and figures. It's *recommended* by boiler insurance companies and endorsed by thousands of industrial power plants, utilities, railroads and marine operators.

But, above all, *it keeps America's veteran boilers on the line,* delivering war-essential power far "beyond the normal call of duty." Write for free bulletins — mail coupon today!

APEXIOR Customers Like These Have Used APEXIOR for Years. 80% of All Orders Are Reorders.

Chicago Bridge & Iron Co.
Inland Steel Co.
Bethlehem Steel Co.
Atlantic Refining Co.
E. I. du Pont de Nemours Co.
Carnegie Illinois Steel Co.
Philadelphia Electric Co.
Chicago, Rock Island & Pacific Ry. Co.
Duke Power Co.
Georgia Power Co.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY of America**
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Mass.

Please send free Bulletin 1290 (General) ☐ 1305 (Marine) ☐ to:

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Company.....

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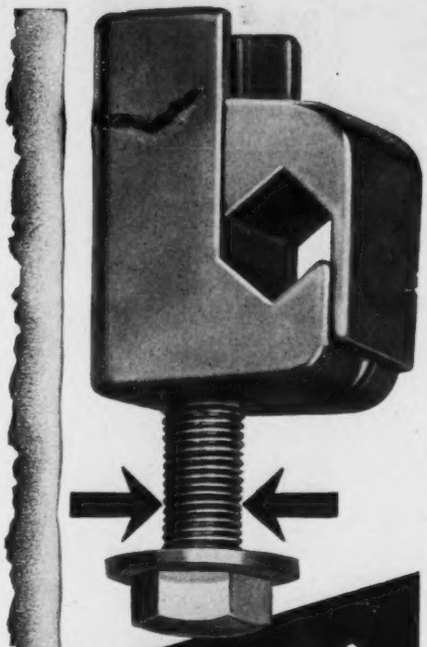
Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y., West Coast, C. C. Moore & Co., San Francisco



why FARGO CONNECTORS tighten so easily

The SMALL BOLT in the Fargo Connector cuts friction to a minimum, tightens the tap in smooth, easy turns. Clean, precisely machined threads in both the bolt and connector body further assure easy, friction-free turning and high pressure contact at low torque. And remember, you can count on a Fargo to "grip like a vise" even after years of repeat use on the line.

Made by FARGO MFG. CO.

Distributed by

LINE MATERIAL CO.

MILWAUKEE • WISCONSIN

mum comfort. The twine is pre-cut in convenient lengths and scissors are used for trimming loose ends.

•

Cost of Laying 22-Kv. Submarine Cable

From the field sheets of a coastal utility which recently laid a three-conductor, 22-kv., submarine cable 4.65 miles long across a salt water channel between two load centers it appears that the cost of the job between shore terminals totaled $78,853, or $3.22 per ft. The maximum depth of water was about 82 ft. and the laying was conducted in a single day, about 15 hours elapsing between the start and completion of this salt water section. The actual laying required about 600 man-hours, including time of men waiting afloat on the day of the job. The costs summarized in the accompanying table include the expense of a barge and crew hired to deliver and unreel the cable, tug and auxiliary boat service.

Summarized Cost of Laying 22-kv. Submarine Cable (Cents Omitted)

Submarine cable, three-conductor, No. 2, three-phase, 24,486 ft.	$47,550
Two complete joint units	650
Hire of barge and crew to deliver and unreel cable	11,000
Hire of tug	2,463
Rope, 4,800 lb. of 5-in.	450
One 1,400-lb. anchor and 600 ft. of ¾-in. cable	45
Chain, 100 ft. of 1-in., and 500 ft. steel cable	42
Special cable reel welded plate, five sections, holding 1 mile of cable per section, and driven by donkey engines	6,027
Hire of boat	544
Laboratory testing of cable, 26,000 ft. total	681
Rope, three coils of ¾ in.	118
Welding rod, 30 lb.	10
Marker buoys, 25 in all	218
Insurance on barge, cable and appurtenances	297
Contractors' charges on job	2,678
Casualty insurance	34
Social security tax	96
Automobile service	175
Interest during construction	578
Miscellaneous items	5,197
Total	$78,853
Actual length laid, 24,486 ft., making cost per ft. laid	$ 3.22

NOTE: A shore section of this job, connecting the submarine section with a substation about 2 miles inland, required 9,450 ft. of No. 2, three-conductor, 22-kv. cable, underground type, costing $16,736, was laid by six men working five eight-hour days. The total cost of this land section was $24,104. The other shore section called for a run of about 1,000 ft. The entire project, including various switching station construction, involved approximately $180,000.

by dipping, spraying or brushing for effective control of decay, "shell rot" or attack by termites or powder post beetles. Also use it on new poles to insure longer service life.

PERMATOX *A* is easy to handle and inexpensive to apply. Available in *economical concentrates* (1 to 10, also 1 to 5) to save freight and cargo space on shipments to foreign utilities.

Furnished in Two Forms:

DOWICIDE 7
Pentachlorphenol* crystals

PERMATOX A
5% Pentachlorphenol* in suitable petroleum solvents

*Manufactured by Dow Chemical Company

Write for Bulletin

A. D. CHAPMAN & COMPANY, INC.

333 N. MICHIGAN AVE. CHICAGO

Memphis • New Orleans
New York • Portland

PUT TERMITES OUT OF BUSINESS

Termites are bad business, and especially bad business for you.

Dowicide 7 is another one of the highly efficient Dow-developed wood preservatives that have been found to be the answer to termite control. These products also serve to protect structural lumber and telegraph poles from decay of all kinds.

The Dowicides are rendering extensive service too in the paper, textile, leather, and paint industries—wherever mold and rot are serious problems.

Dowicide in oil solution is finding increased use as a highly effective and permanent preservative for wood products. The treated lumber is paintable, non-bleeding and easily handled by workmen. Application of Dowicide 7 is made either by pressure impregnation or by open tank soaking methods. Protection for long periods of time has been proven. Write for details on how to put termites—and mold—out of business—your business!

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Washington • Philadelphia • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOWICIDE

GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

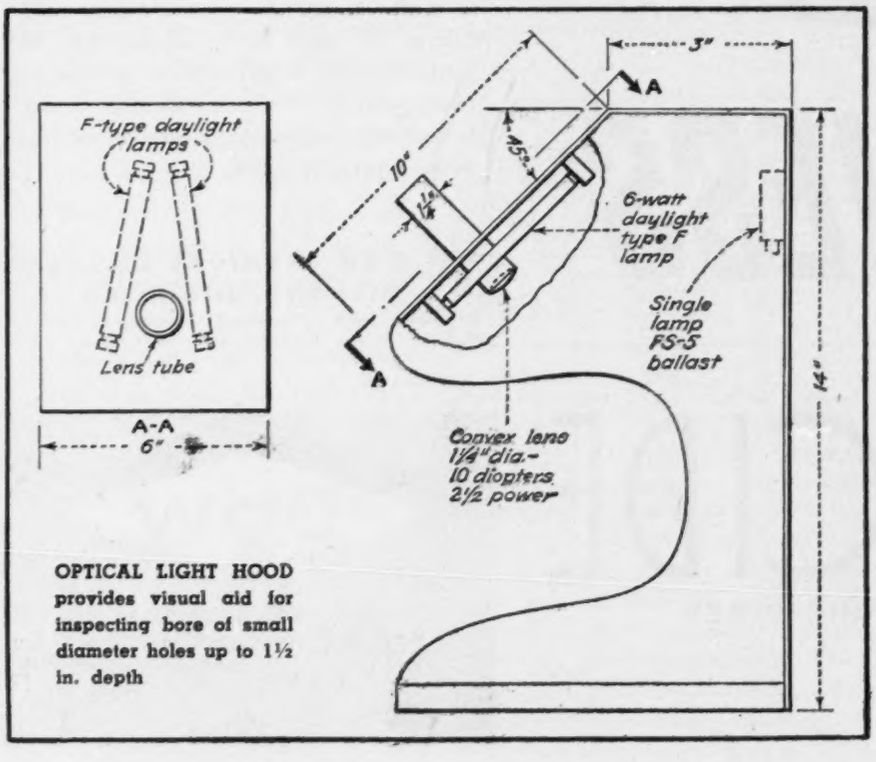
LOAD SERVICING

Industrial • Commercial • Rural • Residential

Optical Light Hood for Die Inspection

The optical light box shown was originally intended as a visual aid for inspecting the bore of final draw dies for .30 and .50-cal. bullet noses when it was designed by L. B. Paist, lighting engineer of Northern States Power Company, Minneapolis. But it fits as well any peacetime inspection job requiring ability to see minute imperfections such as cracks, tool marks or heat pits in highly polished surfaces of closed-end holes up to 1½ in. deep and 0.5 in. in diameter or up to 1 in. deep and 0.3 in. in diameter. Results obtained proved far superior for this purpose to other units previously used.

The appearance of the unit is similar to other optical inspection lights on the market, but differs in the size of the lens and the positioning of the fluorescent lamps used to permit the inspection of inner wall surfaces in small closed-end holes which was not possible with previous units. Paist's design uses an ordinary 2½ power convex magnifying lens of 10 diopters, mounted in a 1¼-in. diameter lens tube. Depth of focus (not to be confused with focal length) of the lens is about 1½ in. This tube is set in a wood panel inclined at 45 deg. to the horizontal, as shown in the sketch, and extends close to the work to be inspected. Two 6-watt daylight fluorescent lamps are mounted on the under side of the wood panel, one on each side of the lens tube to provide the necessary light. Distance between the inside edges of the lamps at the lens tube is 1½ in. To prevent light entering the lens tube and causing veiling glare the lens tube must project slightly beyond the bottom edges of the lamps, but it should not project too far or the tube will obstruct light from the lamps and cast a shadow on the part being inspected.



OPTICAL LIGHT HOOD provides visual aid for inspecting bore of small diameter holes up to 1½ in. depth

Instead of being mounted parallel to each other the two fluorescent lamps are set at an angle so that their axes, extended, would converge to form an inverted V; this reduces specular reflection and results in more light entering the bore. Single lamp 6-watt FS-5 ballasts were used.

Several experiments were tried in evolving this design. The findings point several interesting lessons in applying light to this type of inspection problem. For example: The concentrated light source of incandescent lamps rendered them unsuitable because even with tiny medical lamps specular reflection produced veiling glare on the highly polished surface of the product. Paracyl reflectors proved of no help in reducing the lamp image and flat white paint on the surface behind the lamps resulted in more effective utilization. Keeping lamps back of the lens proved the best method of preventing stray light from reducing visibility. Daylight fluorescent lamps were found definitely superior to 3,500 deg. white lamps for this application.

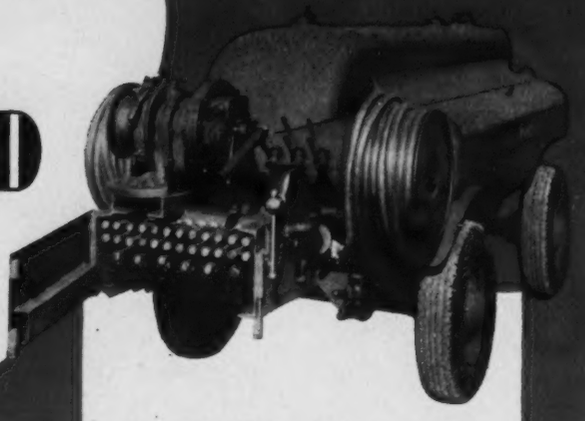
•

Live Services Help Home Transfers

Connecticut Light & Power's 18-month-old policy of retaining live services in domestic installations is working out well from the dual standpoints of public relations and conservation of gasoline, oil, tires and man-power. Formerly the company required the disconnection of electric meters whenever residents moved out of a home or apartment. A second trip was obviously necessary to reconnect for occupancy or in case rehabilitation or redecorating was necessary, and it was disadvantageous to both company and customers to be unable to utilize the lighting service during periods of evening examination of real estate prior to sale or rental.

Under the revised practice whenever an occupant moves from a home, a meter reading is made on the day the resident asks for a discontinuance order, but energy is left available without the necessity of communicating with the company's office. The reading taken on the effective date of the discontinuance is the reading employed in billing the new customer

...Where Power Companies use COMPRESSED AIR



There are so many jobs where compressed air is needed by power companies—and into this versatile picture fits Schramm Air Compressors. Schramm units—both portable and stationary—are extensively used by the utility field in general field service—generating stations—steam plants—repair shops.

They're compact, lightweight, and easy to start merely by pushing a button.

And they have these distinctive "under-the-hood" features: (1) completely water cooled to provide ideal performance both winter and summer (2) seven main bearing supports (3) mechanical intake valve (4) more cylinders and lighter parts (5) forced feed lubrication.

If you are not already using a Schramm, it will pay you to write today for illustrated bulletin 42-PA.

Check this list to see how many ways you can use SCHRAMM COMPRESSORS

FIELD SERVICE

Digging post holes
Coating asphalt
Operating pneumatic drills and hammers
Paint Spraying
Tamping
Breaking pavements
Laying conduits and cables
Sandblasting for removing paint, cleaning, etc.
Wood boring
Picking ice from streets

STEAM PLANTS

Running, chipping, riveting and caulking hammer
Operating drills, reamers and flue cleaners
Supplying hoists, lifts and jacks
Removing scale, rust and paint by sand-blasting

REPAIR SHOPS

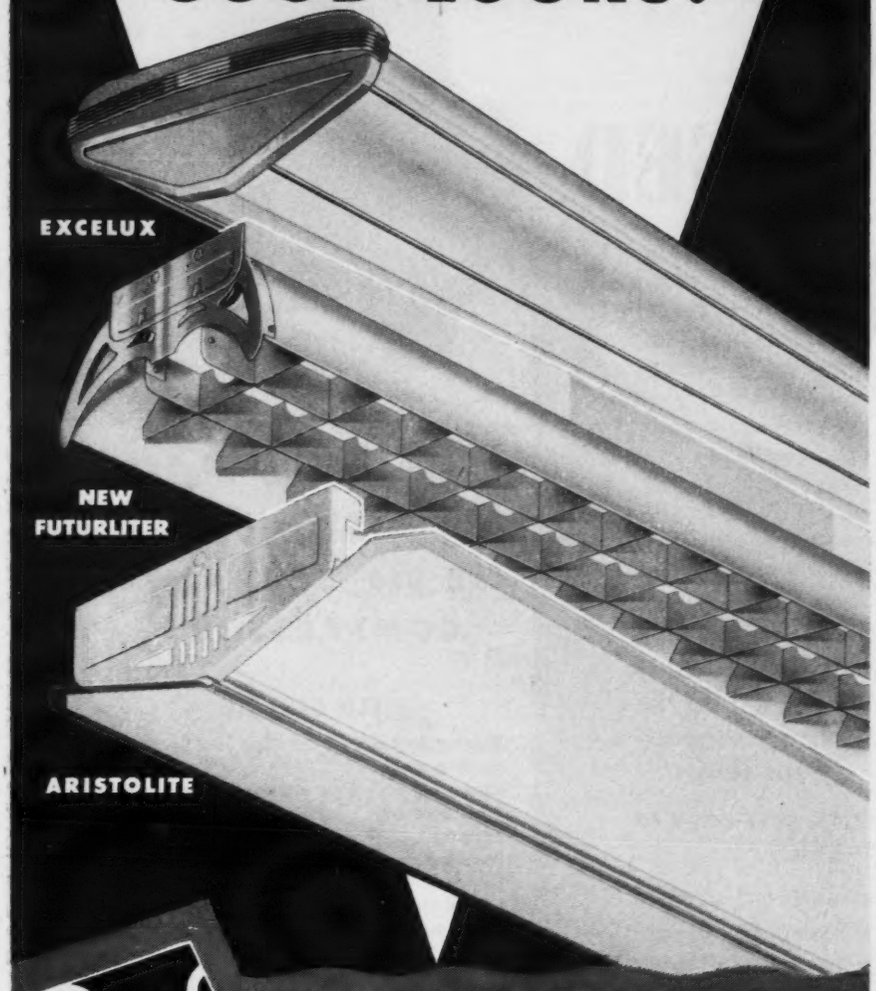
Cleaning engines and machines by jets
Operating jacks, lifts and hoists
Running pneumatic hammers, drills, etc.
Operating brazing forges and smith fires
Supplying oil burners
Tire inflation

GENERATING STATIONS

Operation of air circuit breakers

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

Yes, you Can combine
GOOD LIGHTING
with
GOOD LOOKS!



Guth FLUORESCENT

for Dependable Illumination in Attractive Fixtures!

HERE are three of the new GUTH Commercial Fluorescent Fixtures. A glance tells you they're smartly styled—modern as tomorrow!

And they're efficient, besides. With more than 40 years of lighting leadership, GUTH has the engineering experience to build real quality into GUTH Lighting.

Write today for the new Guth Catalog No. 42.

Leaders in Lighting Since 1902 Guth

★ ★ ★ ★ ★ ★ ★ ★

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

who occupies the premises. When the meter reader has checked the readings on the day a customer moves from a house, he leaves a business reply prepaid postal card tied by a string to a doorknob, kitchen fixture cord or other conspicuous place, to be filled out and mailed by the new customer. This gives the customer's name, starting date of service, whether an electric range is used, the customer's former address, and whether he wishes service at the latter discontinued. This information is immediately transferred to the company's records on receipt. Lighting circuits only are retained in service under this plan, fuses being removed by the meterman from ranges or water heaters to avoid possibility of trouble.

•

Service Plan Sustains Customers' Facilities

By R. F. PULVER
General Sales Manager
Minnesota Power & Light Company,
Duluth, Minn.

Since May, 1942, about a dozen "district advisers" of the Minnesota Power & Light Company, each making eight to ten calls per day, have completed 45,000 visits at the homes of residence and farm customers in Duluth and surrounding areas. In this interval they have routed 18,000 appliances to agencies for repair and themselves have made 1,200 minor repairs on the spot as part of the company's "Home and Farm Electric Facility Conservation Service."

Purpose of the service program has been to maintain contact between utility and customer, help customers keep labor-saving electrical equipment in condition and in effective use and to inform them of war agency measures, particularly regarding nutrition and food preservation programs.

The original plan objective was to make one call per customer per year as a minimum. Personnel shortages have made this impossible. However, 100 percent of the calls were made in 130 percent of the anticipated time and advisers are now on their "second round" of calls. The job was designed so that the plan can be adequately handled by women, who call from house to house following meter routes, preceded by a letter announcing the call and its purpose. During the call each adviser surveys all ap-

Safety Zone

FREE FROM THE BLACK HAND OF ELECTRO-CHEMICAL CORROSION

UNLIKE many dielectrics, Lumarith (cellulose-acetate base), when in contact with current-carrying copper wire, remains unaffected in the presence of moisture, and does not promote corrosion of the wire. In foil and film, it is used as an extra covering for bobbins and spools and as between-layer insulation in wire-wound coils—wherever the black hand of corrosion threatens.

A-78 finished Lumarith foil—matte-surfaced on one side—eliminates the need of talc or lubricants required by ordinary foil when it is slit and wound into cops. A-78 finished foil has good elongation—making it ideal for use in automatic machinery. You are invited to write for booklet of facts about Lumarith plastics and their special electrical applications. Celanese Celluloid Corporation, *The First Name in Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16. *Representatives:* Cleveland, Dayton, Philadelphia, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto, Ottawa.

LUMARITH PLASTICS IN FILM . . . FOIL . . . MOLDING MATERIALS AND OTHER FORMS

LUMARITH*

A CELANESE* PLASTIC

*Reg. U. S. Pat. Off.

Power enough to

Nearly 1,000,000 horsepower per day! That's the growing might of America's air-power! Engines are safer too, more reliable . . . built to higher standards in plants equipped for better *"See-ability."*

Engines today are incredibly precise!

They are built to standards of perfection that make fine watches seem crude. Mechanical failure is almost unheard of.

Modern improved lighting—better "See-ability" for everyone—helps make this possible.

With better "See-ability", technicians more efficiently explore materials for hidden flaws . . . machine operators work to closer limits, turn out parts faster. Inspectors too do their work better.

Brighter, longer-lasting than ever before, today's Westinghouse Mazda Lamps light many of the plants where airplane engines are made.

Watch Westinghouse! When the big job of war production is done, Westinghouse lighting improvements will again be available for factories, offices, stores, homes. Many advances in design, and construction have already been made; dramatic improvements are in the offing. Recommend Westinghouse Mazda Lamps for better "See-ability." Westinghouse Electric and Manufacturing Co. Bloomfield, N.J. *Plants in 25 cities... offices everywhere*

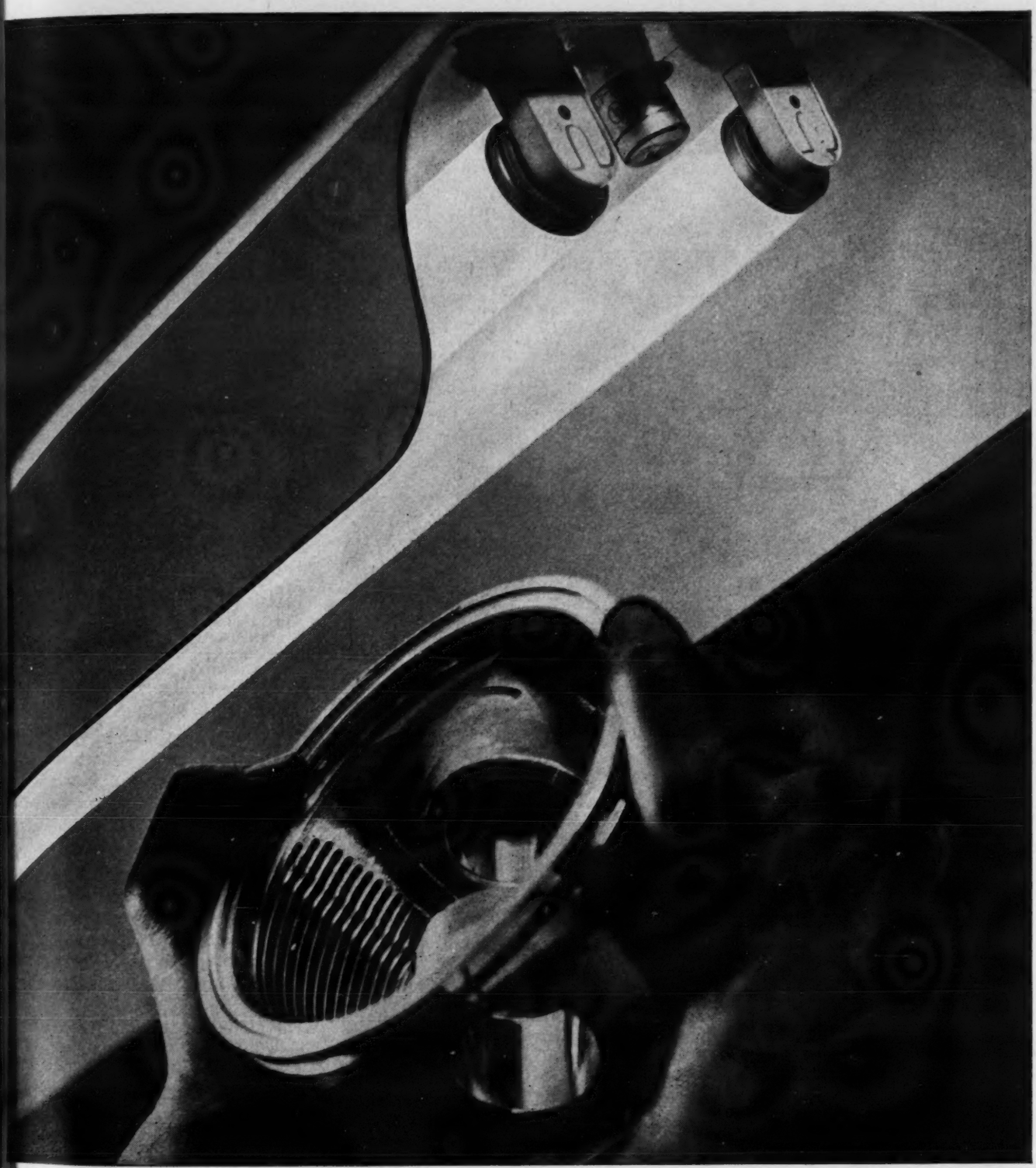
Photographs, courtesy Wright Aeronautical Corporation, Paterson, N.J.

Westinghouse

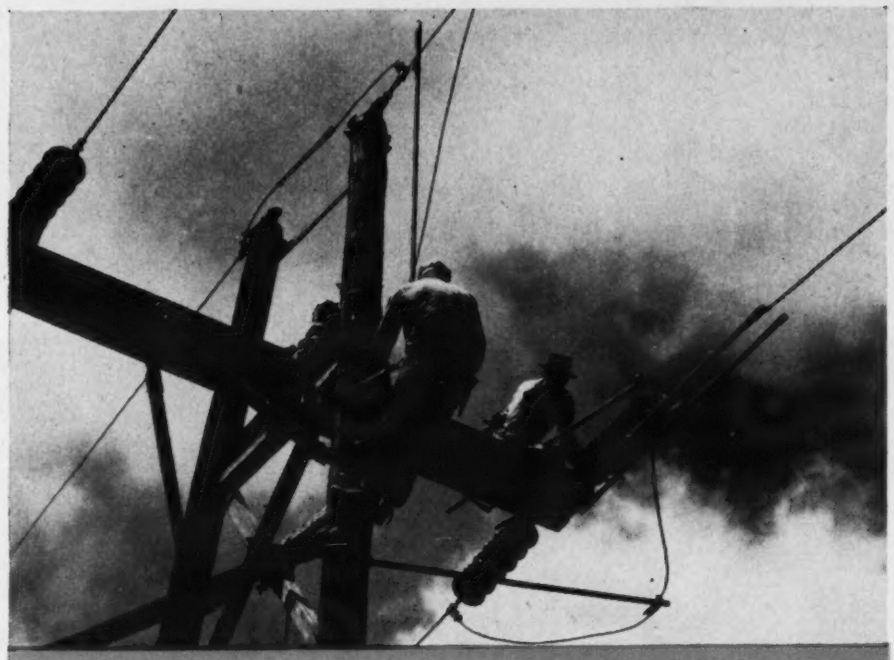
MAZDA LAMPS

FOR BETTER "SEE-ABILITY"

sweep the skies



★ LET'S ALL BACK THE ATTACK . . . BUY *MORE* WAR BONDS ★



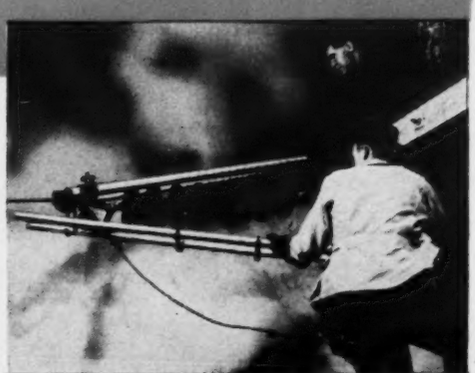
Changing dead end insulators "hot" is a simple, safe job with..

TIPS TOOLS

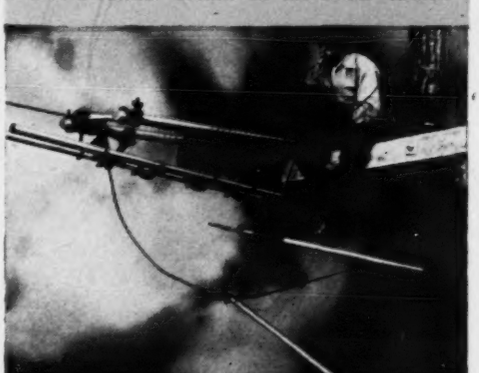
New "cradle" device simplifies handling of insulator strings

Changing dead end insulators on high voltage lines without interrupting service is an operation that usually requires less than an hour's time with the use of Tips Tools. Linemen work in complete safety and by using the new Tips suspension cradle for carrying the weight of released insulators, the job becomes a simple task.

The above photo shows an insulator change being performed on a 66 KV line. Note that the jumper has been placed at a safe distance with a wire tong. The operator is attaching the cradle under a strain carrier. The close-ups at right illustrate two steps in the procedure for removing a string of insulators on a 110 KV line. By this method, the job can be done in the same amount of time that would be required to do the job cold, thus the time required for obtaining clearances, switching, etc., can be saved. The big factor, of course, is the prevention of outages. Cut the risk of long service interruptions by outfitting Maintenance crews with Tips Tools for quick, safe repairs while the power is on. Get the details from our catalog or write for specific information.



Here the strain carrier has been applied and the lineman on the pole is placing the cradle in position under the insulators. Strain will be released with a ratchet wrench on the strain carrier.



After strain has been released from the insulators, the lineman on the pole releases the cotter key with a key puller and insulators are pulled in on the cradle for making changes.

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES

pliances as to condition, need for maintenance, care and repair.

Where the repairs are needed, the adviser tells the customer how to proceed, stressing conservation of workman's time, automobile delivery, use of critical materials, etc. Customers are warned not to expect "come out and look it over estimates" or free "see what you can do with it" deals. Advice is rendered where needed on more effective appliance use. The remaining call objective is to unearth spare equipment and get it back into use either by the owner or by offering it for sale to others. Such equipment is listed by the company and offered to inquiring customers; the transfer is arranged by customers themselves.

Aid to Repair Agencies

The task of referring repair to authorized agencies has not been without its difficulties. Some agencies have not been interested in additional work owing to difficulty in obtaining repair parts and collecting fees from customers. Other agencies, on the other hand, have recognized an obligation to their customers and have by one means or another continued to render high-grade appliance service under severe handicaps. An attempt has been made by the company to aid such agencies by:

(a) Helping out with suggestions.
(b) Loaning tools and equipment.
(c) Furnishing manpower.
(d) Holding schools for workmen.
(e) Supporting the repair agency policies with advertising.
(f) Educating the public.
(g) Helping secure repair parts.

Food preservation clinics and classes have been held as part of the program in some 44 localities, with an attendance estimated at over 1,000 persons. A low-cost electric dehydrator designed to be built by the home handyman or manual training student has been developed by the company; free plans and instructions have been furnished. The company also procured 50 victory model steam pressure canners, which it loaned to local families without charge as part of the service. About 18,000 pints of non-acid food have been processed with this equipment.

Result-wise the most appreciated angle of the service program has been the visit itself. Families at war have been pushed around considerably. Customers have learned to depend greatly upon electric service. No good end is served by breaking down that

*Copr. 1944 RCC

"For Immediate Delivery" —says *Romey

How's this for a stock of weather-proof wire!

All the popular sizes and tempers. This is why we can give you such speedy service. Call us—anytime.

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CHICAGO 6, ILL.
BOSTON OFFICE
MARSHFIELD HILLS, MASS.
CLEVELAND 14, OHIO
PITTSBURGH 19, PA.
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LOS ANGELES, CALIF.
DETROIT 2, MICH.

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FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

ROME • NEW YORK

Certified!
Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y.
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
E·T·L
E·T·L
WAKEFIELD
SPERO
SMITHCRAFT
CURTIS
SEGIL
GRUBER
KEYSTONE
MITCHELL

NEW COMMERCIAL FIXTURES BEARING FLEUR-O-LIER LABEL *now ready!*

FLEUR-O-LIER Manufacturers, following the recent amendment to WPB order L-78, offer you a wide variety of new commercial-type *certified* fluorescent fixtures. And additional designs are on the way—from many other FLEUR-O-LIER sources other than those shown.

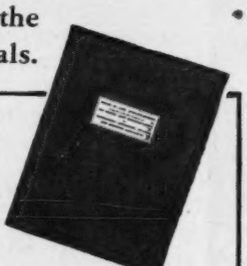
Essential offices, factory drafting rooms, hospitals, and various public institutions can obtain these new units on a priority of A-1-j or higher; and on an MRO order on a priority of AA-2 or higher.

Protection for supplier and user

The big news about these new fixtures is that they give you the famous CERTIFIED FLEUR-O-LIER protection, dependability and service. Like all other types of fixtures bearing the FLEUR-O-LIER label, these commercial-type units are tested and checked by impartial experts—Electrical Testing Laboratories, Inc. of New York . . . and *Certified* by them as meeting FLEUR-O-LIERS' 50 definite standards of electrical, mechanical and lighting excellence.

Better than ever!

These new FLEUR-O-LIERS combine the best features of pre-war equipment, plus improvements developed to aid the war effort. And, of course, all of the various leading fixture manufacturers making these units conform to WPB limitation orders in the use of critical materials.



GET THIS BOOK!

You'll want this valuable book containing complete FLEUR-O-LIER engineering specifications. You quickly see why Certified FLEUR-O-LIER fixtures give you the protection and dependability you need and want. With it you get the FLEUR-O-LIER story and list of manufacturers. Write FLEUR-O-LIER Manufacturers, 2126-1 Keith Building, Cleveland 15, Ohio.

Let's all BACK THE ATTACK—buy more War Bonds

Some of the fixtures shown have already been certified . . . others are in the process of testing and certification.

FLEUR·O·LIER

Manufacturers

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

5 YEARS EXTRA USE
for 5¢ EXTRA COST!

HARPER fastenings add years and years to the service life of products and equipment on which they are used . . . and do it at a trifling extra first cost. They insure your product against the ravages of rust and corrosion. They resist numerous acids and alkalies . . . ocean salt . . . tropic sweat. They save hours of time and labor required to replace rusted common steel bolts . . . prevent failure of vital equipment . . . keep production rolling . . . are repeatedly removable. In certain alloys they are non-magnetic and non-sparking. 4320 items in stock. Write for 96 page catalog in 4 colors.

The H. M. HARPER COMPANY
2611 Fletcher St. • Chicago 18, Ill.
BRANCH OFFICES: New York City, Philadelphia, Los Angeles, Milwaukee, Cincinnati, Houston. *Representatives in Principal Cities*

HARPER
EVERLASTING FASTENINGS

dependence and substituting other methods, particularly when those other methods do not aid the war effort. Call records show clearly that customers are relying to a considerable extent upon labor-saving and health-protection appliances to aid them in their war contribution. It is the purpose of this service program, therefore, to establish that such reliance is justified and that the faith which is its foundation is not misplaced.

•

Home Service, Home Lighting

By S. S. BRADFORD
Potomac Edison Company, Hagerstown, Md.*

Should home lighting be organized separately or be an integral part of the home service job? In our own company, in years past, we had completely separated home lighting and home service departments with separate directors. This was followed several years before the war by separate departments with a common director. During the last two years our home service-home lighting numerical strength has been maintained at a minimum of two-thirds of pre-war strength and it has operated as an all-purpose department, including both the advisers and the director.

Frankly, there are still some differences of opinion concerning which type of organization is best. Personally, I feel that the combined all-purpose organization is best for a small town and rural area such as ours. This type of group offers one point of home service contact, provides for more effective use of time, reduces travel needs somewhat and serves the homemaker through one individual, giving additional opportunity to the adviser to sell herself and the company through a complete, all-purpose home service, and a greater possibility for the development of friendly contact, especially where the all-purpose job cannot be accomplished on one call.

While the type of area served by the company, as well as local merchandising and promotional policies may well lead to different conclusions, the question of the type of organization for the future is, I believe, an important one.

*From paper to Southeastern Electric Exchange

VIRTUALLY every section of the country is dotted with American ridge transmission towers — over 0,000 of them—carrying a large por- on of the vital electrical energy that rns the wheels of America's war ants.

You don't hear much about these wers. The very fact that they stay ut of the news is mute testimony of eir year-after-year reliability. Utili- es have learned to count on Ameri- can Bridge towers as a means of as- suring continuity of electrical service and low maintenance. And they have learned that these individually engi- neered structures serve equally well for transmission across difficult mountainous terrain, or over rivers, deserts and wide plains.

Through these war years, as in every year since 1905, each trans- mission tower we design and fabri- cate is given the benefit of specialized engineering. One entire plant is de- voted to the fabrication and galva- nizing of transmission towers. It is equipped with the country's most modern test frame for proving even the largest line towers in use.

As each new American Bridge tower goes to its war assignment, we can offer just that much more engi- neering and construction experience for meeting your postwar planning and peacetime needs.

AMERICAN BRIDGE COMPANY

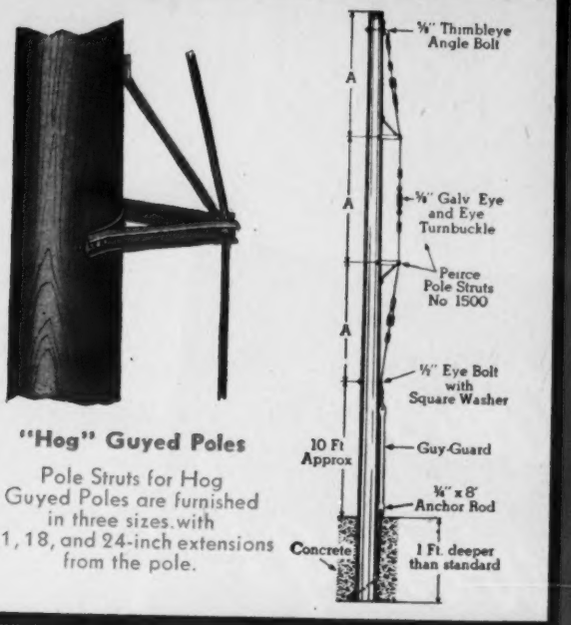
General Offices: **Frick Building, Pittsburgh, Pa.**

Baltimore · Boston · Chicago · Cincinnati · Cleveland · Denver · Detroit · Duluth
Minneapolis · New York · Philadelphia · St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

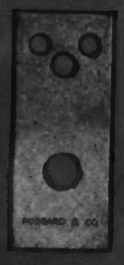
HUBBARD HARDWARE


⅝" Thimbleye Angle Bolt
⅝" Galv Eye and Eye Turnbuckle
Peirce Pole Struts No 1500
½" Eye Bolt with Square Washer
Guy-Guard
¾" x 8' Anchor Rod
10 Ft Approx
Concrete
1 Ft. deeper than standard

"Hog" Guyed Poles

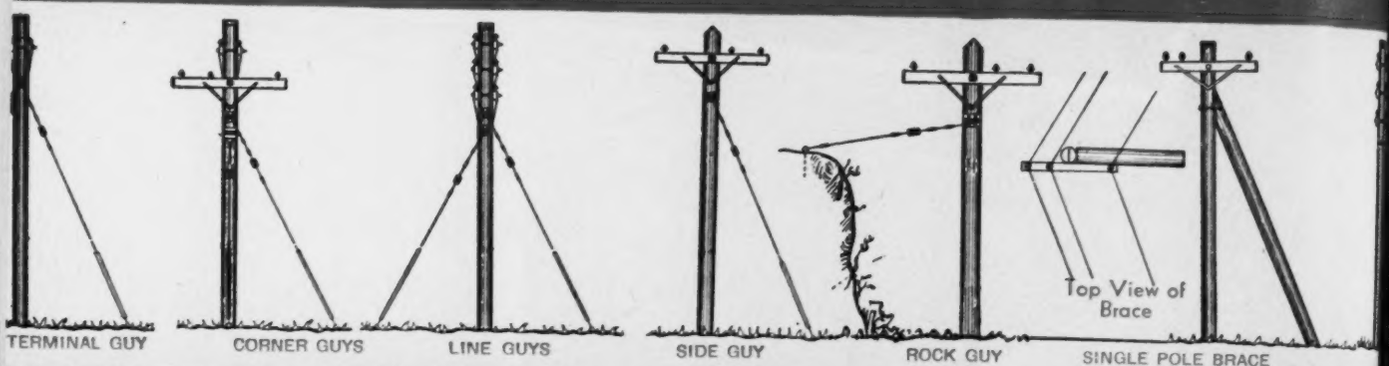
Pole Struts for Hog Guyed Poles are furnished in three sizes with 11, 18, and 24-inch extensions from the pole.

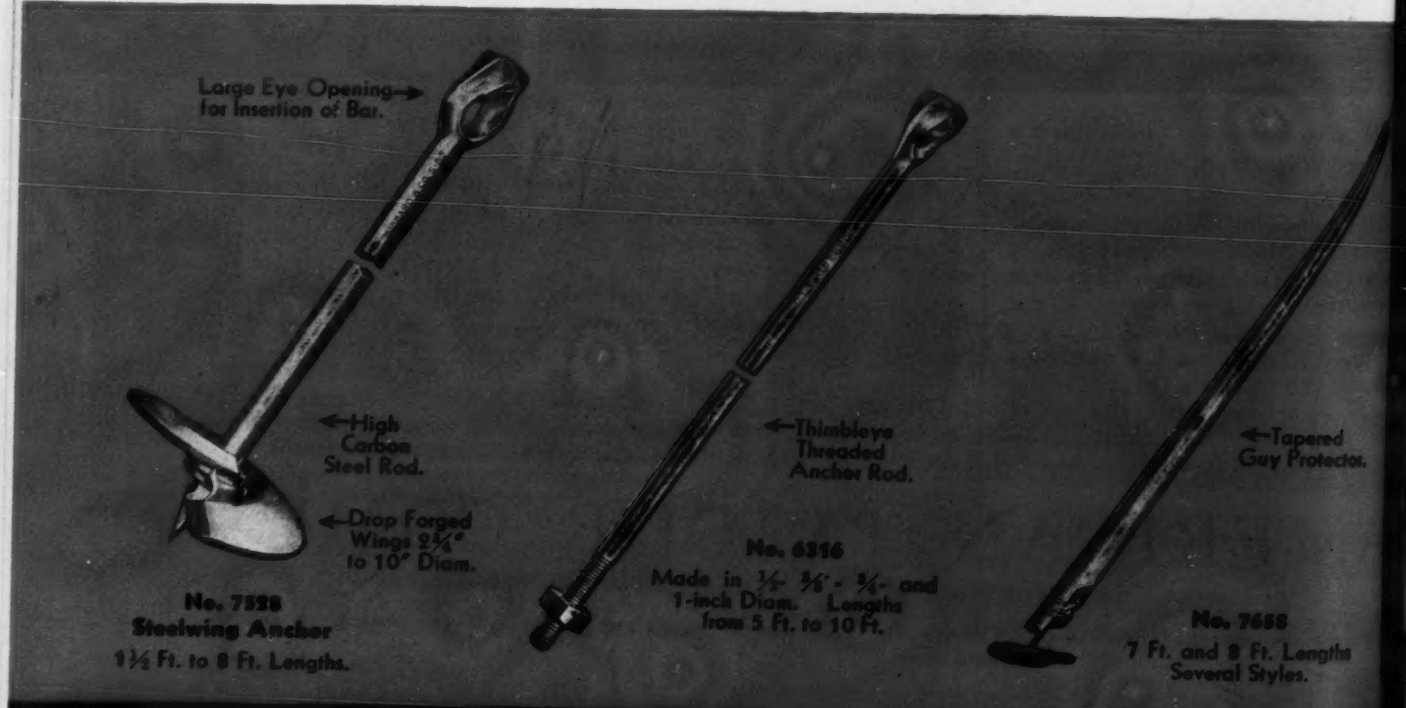
No. 6012
Angle Thimbleye Bolt
Furnished in sizes from ⅝-inch to 1-inch Diam. and 8-inches to 18-inches in length.



No. 8891 Load Plate
Furnished in several sizes and styles, curved and flat.

No. 7510 Thimbleye
Sizes for ½- ⅝- ¾- and 1" bolts, Double and Triple




Large Eye Opening→ for Insertion of Bar.
←High Carbon Steel Rod.
←Drop Forged Wings 2¾" to 10" Diam.
←Thimbleye Threaded Anchor Rod.
←Tapered Guy Protector.

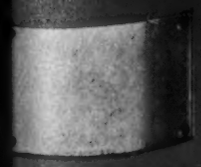
No. 7528
Steelwing Anchor
1½ Ft. to 8 Ft. Lengths.

No. 6316
Made in ½- ⅝- ¾- and 1-inch Diam. Lengths from 5 Ft. to 10 Ft.

No. 7658
7 Ft. and 8 Ft. Lengths
Several Styles.

"Hang the Load on Hubbard Hardware"

FOR ALL TYPES OF GUYS

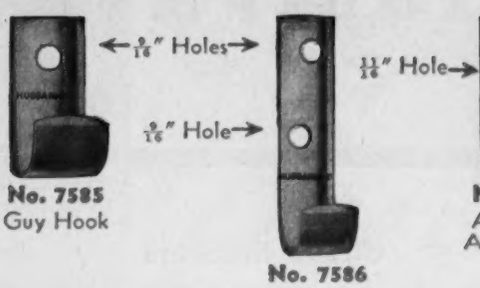


7575 Strain Plate

...es are plain and for ...ulding. Also with ...y Hooks attached.

... 7461 Guy Clamp

... two, three and four-bolt ... for all standard strand.



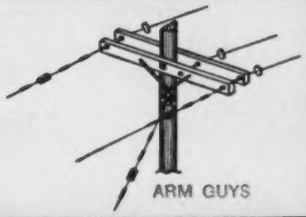
No. 7585
Guy Hook

No. 7586

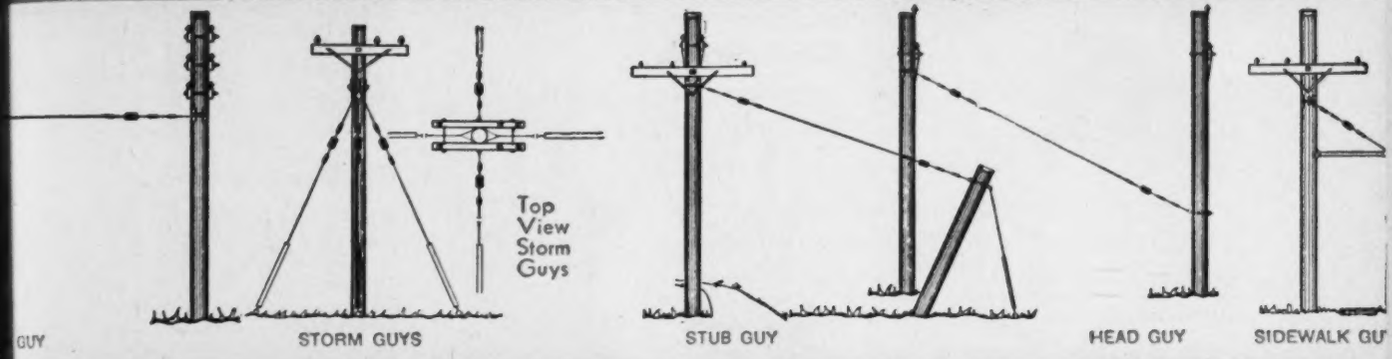
No. 6004
Arm Guy Attachment.

No. 6001
Storm Guy Attachment.

No. 9786 Double Arming Eye Bolt
5/8" and 3/4" Diameter—16" to 20" Lengths.



ARM GUYS



...GUY

STORM GUYS

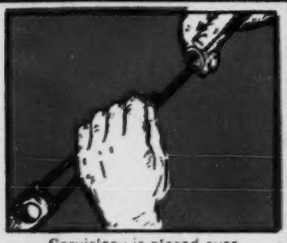
STUB GUY

HEAD GUY

SIDEWALK GU...

No. 7454
Servisleev

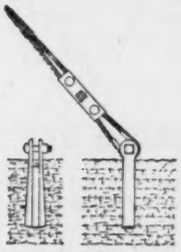
...izes for Strand ...om 3/16" to 1/2" Diameter



Servisleev is placed over strand so bell mouth can be turned toward clamp.

—Turned toward clamp bell mouth is driven over loose end of strand.

Installation of Rock Guy Anchor with Split End and Wedge.



No. 7545
Wedge and Shim Type Rock Guy Anchor.

No. 7595
Guy Thimble
Sizes for all standard strand and Anchor Eyes.

No. 7547 Rock Anchor

HUBBARD

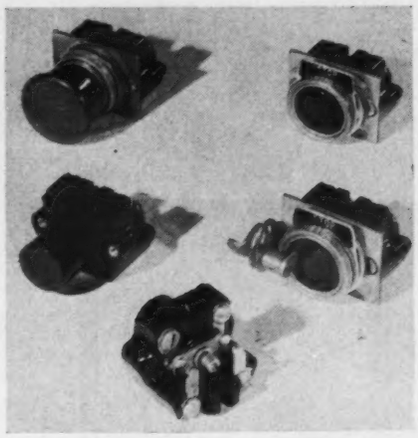
HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND . . . CALIFORNIA . . . CHICAGO

NEW EQUIPMENT

Push-Button Units

New push-button units are made of smooth, hot-molded, moisture-resisting phenolic compound. Responsive, double-break contacts are of fine-silver and have a



Standard-duty push-button units; (left to right) with snap-on mushroom head, interchangeable nameplate, extra long button, tamper-proof locking attachment, and rear view of a standard unit showing construction of contacts; available in both pendent and oilproof types. **General Electric Co.**, Schenectady, N. Y.

steel back projection, protected by rust-resisting plating, welded to the contact supports. Their small size permits mounting several of them in a relatively limited space. Oilproof units are similar to pendent type except that they are provided with an especially treated leather ring packing.

•

Lighting Unit

New industrial fluorescent lighting fixture is available for areas where high levels of illumination are required or where high-bay mounting is necessary. It is suitable for individual or continuous row mounting and is of the same basic streamlined design as the recent 40-watt lamp models. A single piece non-metallic reflector board finished in baked enamel is removable from the top housing by a quarter turn of latches. Starters are located between the lamps.

Model "HF-235R" industrial lighting fixture; utilizes two 100-watt fluorescent lamps. **Sylvania Electric Products, Inc.**, Salem, Mass.

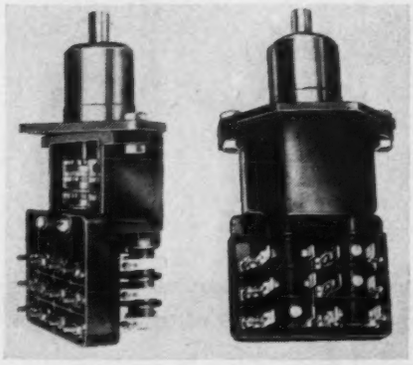
Circuit Breakers

Types "D-7229," "D-7230" and "D-7231" remote-control circuit breakers; three frame sizes with current ratings from 35 to 200 amp., for circuits up to and including 30 volts d.c. or 220 volts a.c. **Spencer Thermostat Co.**, Attleboro, Mass.

Breaker-relays indicate circuit operation and can be reset from a control panel. Actuating element is a snap-acting disk which is said to be unaffected by motion, vibration or shock such as is encountered in aircraft and mobile equipment. The breaker is stated to carry at least 115 percent of rated current continuously and will ultimately trip at 125 percent of rated current in an ambient of 25 deg. C. (77 deg. F.).

•

Limit Switch



Geared limit switch; adjustable for operation between 2 and 3333 turns of the driving shaft at speeds ranging from 10 to 500 r.p.m.; contacts rated for voltages up to 550 volts a.c. or d.c. **Philadelphia Gear Works, Inc.**, Erie Ave. and G St., Philadelphia 34, Pa.

All-molded constructed limit switch has two individually adjustable trains of intermittent gears, each train operating one contact drum having three double-break, silver, wiping-action contacts. Two contacts may be normally open and one normally closed or vice versa. Mounting may be in any position and watertight, weatherproof inclosures can be supplied.

•

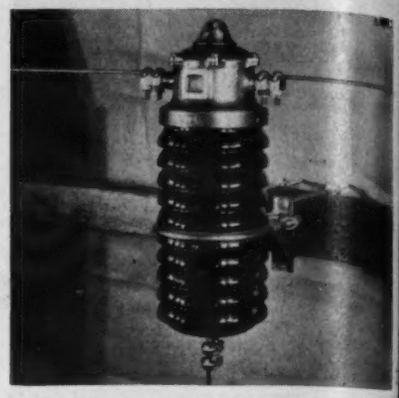
Fire Extinguisher

"Model FF-4" portable carbon dioxide fire extinguisher; size, 4 lb. **Randolph Laboratories, Inc.**, 8 E. Kinzie St., Chicago, Ill.

New fire-fighting device features self-aimed, fixed fire-resistant discharge horn and thumb-operated trigger valve to release carbon dioxide. Operator grasps the extinguisher's arched-steel handle, while the thumb presses the trigger directly above, thus leaving one hand free for precautionary measures.

Shorting Contactor

Self-contained, automatic, single-pole contactor has been designed to short circuit or reduce the line voltage to zero between the fault and source of power. Operation is stated to be between one-half to two



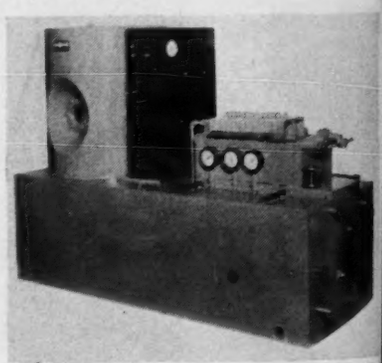
Type "LSC" line shorting contactor; ratings 50-100 or 100-200 amp., 7.5/12.5 kv.; lockout time 1¾ to 2½ minutes. **Railway & Industrial Engineering Co.**, Greensburg, Pa.

cycles, depending upon the magnitude of the fault current. The relatively slow-acting station breaker opens in the usual manner and the sectionalizing fuses are undamaged. Mechanical lockout timing device is adjustable. There is included an operation counter and a target system which indicates normal operating and short-circuit positions.

•

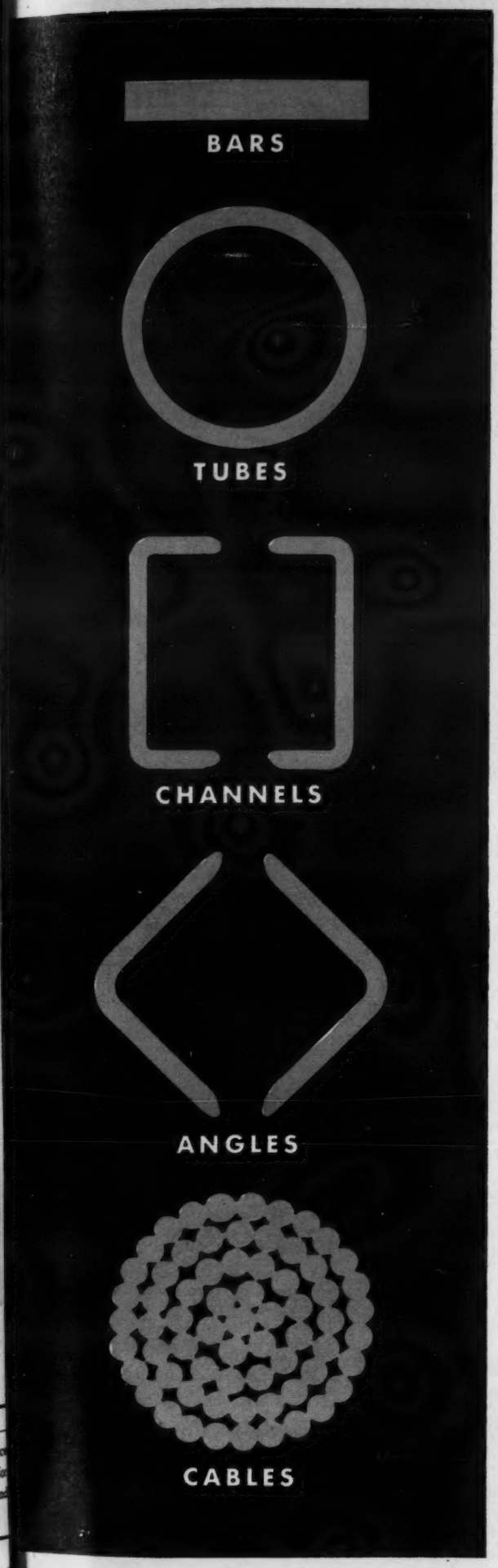
Oil Purifier

An addition to the company's line is a unit to produce dehydrated, degasified, deoxidized and filtered insulating oil. Treating chamber has no moving parts that require cleaning or adjusting. The manufacturer states that this newly designed unit retains the features that are inherent in the larger models, viz., operation while the transformers remain energized, low temperature, and high vacuum treatment of oils in a chamber free from contact with air.



"Hydrovolifier" insulating oil maintenance unit; capacity 100 gal. per hour. **Buckeye Laboratories Corp.**, 2890 East 83d St., Cleveland, Ohio.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.



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Because of its high conductivity and consequent low current losses, copper has always been the most widely used material for bus conductors.

To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the wide range of *copper bus shapes made by The American Brass Company will meet every requirement.*

In addition to a complete line of copper bus bars of rectangular shapes, this Company makes high conductivity pipe and tube, stranded cables and many special shapes.

Of particular interest to electrical engineers are the ventilated busses made from channels, angles, tubes and rectangular copper bars. Information, including our Bus Conductor Booklet, C-25, and the suggestions of our Technical Department on various bus conductors and assemblies, is available on request. 44108

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Type CW Air Break Switches

● Designed electrically and mechanically to provide more than just efficient performance—actually built to give life beyond the age of the substation. This Hi-Voltage CW Switch is attractive in appearance, involves low installation cost, offers ease of operation and unmatched dependability . . .

Closing—the switch arm swings to the horizontal position in alignment with the contact—moves endways through opening of contact housing into contact.

It is essential that a switch mechanism develops its most powerful leverages at the open and closed positions. Hi-Voltage accomplishes this with a completely housed linkage which controls the motion of the switch arm.

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TECHNICAL LITERATURE

STANDARDS—A compilation of A.S.T.M. Standards on Paper and Paper Products includes 40 specifications, test methods and related standards. Three specifications are for electrical insulation. Copies of this 144-page publication can be obtained from American Society for Testing Materials, 260 South Broad St., Philadelphia 2, Pa.; price $1.35 per copy.

STANDARDS—More than 600 standards covering specifications for materials, methods of tests, dimensions, definitions of technical terms, procedures, safety and war standards are listed in a publication "American Standards," revised to December 1, 1943. The booklet is available from American Standards Association, 29 West 39th St., New York, 18, N. Y.

TEST SCALE AND RECORD—A 3x6-in. paper form provides a record for weld bend test data and has a table giving the required elongation to cover practically all cases. Each sheet has on one edge a 3-in. measure ruled in 1/50ths of an inch for applying to sharply curved surfaces. A pad (25 sheets) of the Tempilscale forms can be obtained by addressing a request on your company's letterhead to Tempil Corporation, 132 West 22d St., New York 11, N. Y.

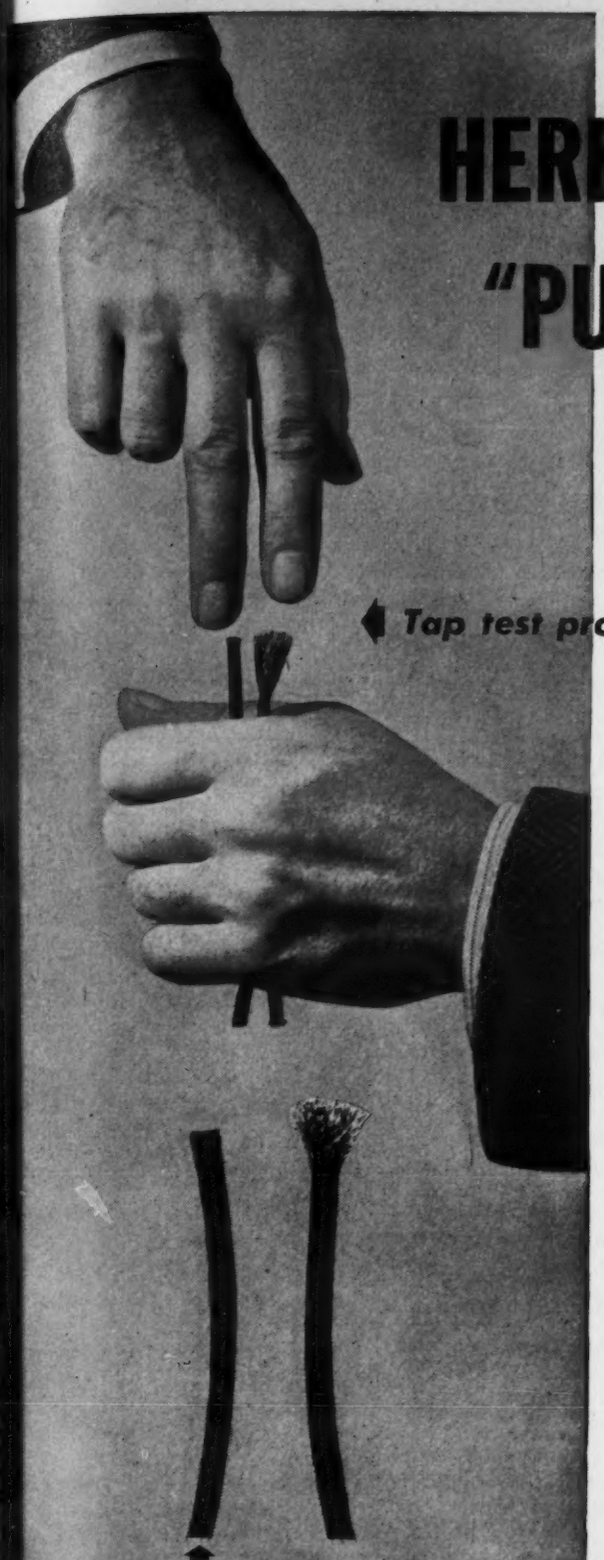
TRANSFORMERS—Based on U. S. Government weather reports, a "Winter Overload Map" and the information accompanying it indicate the amount of overload that self-cooled and forced-air cooled power transformers can carry in winter months in specific regions throughout the country. The map is obtainable from the Pennsylvania Transformer Co., 808 Ridge Ave., Pittsburgh 12, Pa.

"MAINTENANCE ARC WELDING," first volume of its kind published by the Lincoln Foundation, is a compilation of 25 outstanding maintenance studies from the 1940-1942 Industrial Progress Award Program. The information deals with the use of arc welding in reclaiming broken and worn parts and in the fabrication of replacements. The 6x9-in. publication may be secured from the James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio; price 50 cents per copy in U. S. A.

"SIGNAL SYSTEM, CABLE AND WIRE DATA" is a 24-page, loose-leaf booklet containing telephone cable color code, interphone telephone cable, switchboard telephone cable, wire types and conduit sizes, resistance and carrying capacities of wires. Copies are obtainable from Cannon Electric Development Co., 3209 Humboldt St., Los Angeles 31, California.

"PYROMETER ACCESSORY MANUAL" gives engineering data on the selection and installation of thermocouples, protection wells and lead wire, calibration data and tables. Copies of this manual, Bulletin P1211, can be obtained from the Bristol Company, Waterbury 91, Conn.

WELDING—A 38-page booklet, "Eutectic Low Temperature Welding," provides a rod-selector chart for 43 Eutectic alloys, outlines the process of welding, and gives procedures for fabrication, salvaging and general maintenance, and lists ferrous and non-ferrous metals that can be welded. Copies of the data book are obtainable from Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.



HERE'S HOW TO "PUT THE FINGER" ON SLEEVING—

Tap test proves new BH "extra flex" Fiberglas Sleeving is non-fraying

HERE's a new sleeving that is *both* flexible and non-fraying. And you can prove it *right at your own desk* with this simple tap test:

Obtain from us a sample of BH Extra Flexible Fiberglas Sleeving equal in size to the saturated sleeving you use now. Hold both types in your left hand, as illustrated, and finger-tap each sleeving 15 to 20 times. BH Extra Flexible Fiberglas Sleeving will spread slightly, may fuzz a little, but it will not fray. The usual saturated sleeving will break down at the edges and separate. Continued manipulation will not noticeably affect the BH Extra Flexible Fiberglas Sleeving, whereas the saturated sleeving will readily unravel and become progressively worse.

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The new BH Extra Flexible Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

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ESSENTIAL IN *WAR*
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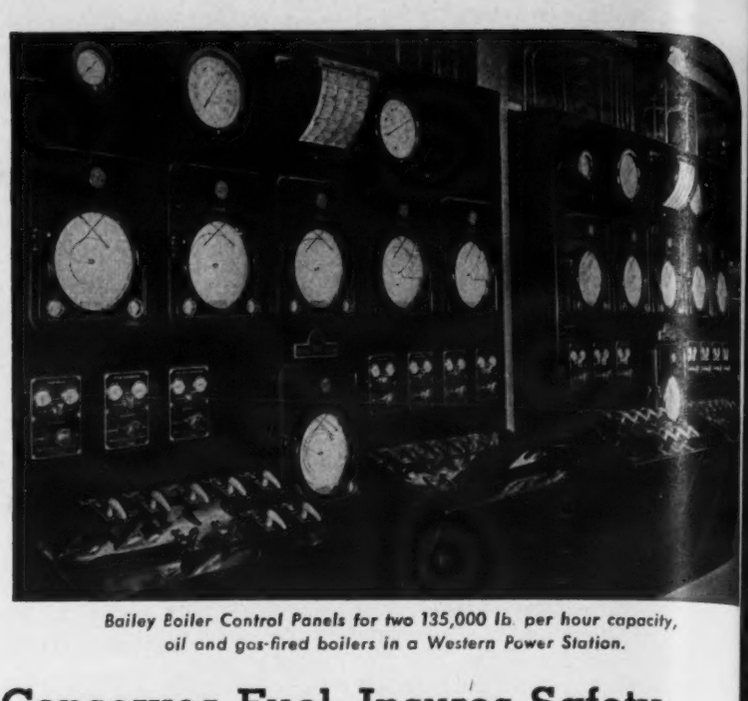

Bailey Boiler Control Panels for two 135,000 lb. per hour capacity, oil and gas-fired boilers in a Western Power Station.

Bailey Boiler Control Conserves Fuel, Insures Safety, Increases Turbine Efficiency, Improves Continuity of Service and Simplifies Training of Operators

☆ The same qualities of Bailey Boiler Control which make it essential in wartime power plant operation, make it profitable to use in peacetime operation.

It conserves fuel and fuel transportation facilities by automatically maintaining the correct fuel—air ratio for efficient combustion at all times.

It insures against accidents to operators and equipment by:

Accurate control of boiler water level, steam temperature and fuel—air ratio.

Interlocks to insure the proper sequence of operation.

Limiting devices to prevent operation under unstable conditions.

Alarms to warn operators of dangerous conditions such as high or low water level, flame failure, loss of air pressure, etc.

It increases turbine efficiency by supplying steam at design pressure and temperature at all times.

It improves the continuity of service by reducing furnace and boiler repairs.

It simplifies training of new operators and insures continuous economy during the training period.

These same qualities of Bailey Boiler Control which are now helping to win the war will help American industry to win the peace.

Suggestions for wartime boiler plant operation are given in our Bulletin No. 16 "How to Safely Stretch Steaming Capacity." Ask for your copy now. A-90

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NEWS ABOUT PEOPLE

Thomas & Betts Makes Executive Appointments

Adnah McMurtrie, vice-president and ne of the founders of Thomas & Betts Co., Elizabeth, N. J., has retired after 0 years in the electrical industry. In 905, at the time the Thomas & Betts Co. was incorporated, Mr. McMurtrie, n electrical engineer, was made secre- ary and a director of the company. He ecame vice-president in 1940. Mr. McMurtrie will continue to serve the ompany in the capacity of a director.

N. J. MacDonald has been made vice-

. J. MacDonald

resident of the company. Mr. Mac- onald joined the Thomas & Betts Co. 1921. In 1929 he was elevated to e position of sales manager. Six years ter he was made a director of the mpany and in 1940 became vice- resident in charge of sales.

E. C. Hewitt, who has been promoted om acting sales manager to sales anager, joined the organization in 29. In 1937 he became manager of e New York City office and district anager of the New York and Connecti- t territory. In 1941 he went to the lizabeth factory as acting sales man- er.

•

W. P. SHAFFER has been appointed strict manager of the Southern California Edison Co. at Pasadena, succeeding C. M. CAMPBELL, who will be Santa Monica district manager.

► JOHN T. MOONEY has been appointed plant superintendent of the Pinopolis works of the South Carolina Public Service Authority (Santee-Cooper). A graduate of the Lewis Institute, Chicago, Mr. Mooney was formerly plant superintendent of the Loup River Public Power District in Nebraska.

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M. M. Kenneally Joins Joslyn Mfg. Staff

M. M. Kenneally, formerly vice-president and sales manager of the Porcelain Insulator Corp., Lima, N. Y., has recently become associated with the Joslyn Mfg. & Supply Co. with headquarters at Chicago. In addition to his regular duties he will continue to act as special representative for the Porcelain Insulator Corp.

Mr. Kenneally brings to his new position a broad background of experience in the electrical industry, including fifteen years in the operating and construction departments of the utility field and seventeen years in engineering and sales of high-tension insulators.

Following graduation from Iowa State College in 1915 with an electrical engineering degree, Mr. Kenneally joined the engineering staff of the American Gas Co. as a field engineer. During World War I he served in the capacity of engineering officer in the transport service of the U. S. Navy. After the war he returned to the American Gas Co. When the United Gas Improvement Co. took over American Gas, Mr. Kenneally was made operating engineer of the Iowa Public Service Co. and later transferred to the Philadelphia office as assistant to the electrical engineer of all U.G.I. properties. Joining the Ohio Brass Co. in 1927, he was appointed manager of the power utilities department three years later; then followed his connection with the Porcelain Insulator Corp. in 1937 in the capacity of sales manager. In 1939 he became vice-president and sales manager.

E. J. Westerlund Directs Industrial Relations

E. J. Westerlund has been named manager of a newly established industrial relations division at Nela Park headquarters of General Electric lamp department.

The new division has for its chief purpose the rendering of industrial relations service to nearly fifty main manufacturing divisions of the General Electric lamp department throughout the country, meeting with employee bargaining groups, interpreting policies affecting rates and working conditions, conducting negotiations involving dis-

putes which may be carried to union officials or War Labor Boards for settlement and making recommendations for improvement of employee relations.

Mr. Westerlund joined the staff of lamp development laboratory of General Electric, Nela Park, in 1934. He served as engineer for G.E.'s Trumbull Lamp Works, Warren, Ohio, from 1938 to 1941, after which he was made manager of the Cleveland base works. During the past two years Mr. Westerlund devoted his efforts to parts manufacturing and industrial relations at Nela Park.

•

► HOWARD C. MILLER has been appointed assistant laboratory engineer by the Public Service Electric & Gas Co., Newark, N. J. Mr. Miller has been connected with the company since 1924.

► JOHN P. ROCHE, counsel and assistant secretary of Oliver Iron & Steel Corp., Pittsburgh, has been appointed assistant to the president of that organization. E. C. EAGLEN will head the new department of market research. Both Mr. Roche and Mr. Eaglen will be located at the company's headquarters in Pittsburgh. Mr. Roche will continue his duties as counsel and assistant secretary. Mr. Eaglen's new duties will include the

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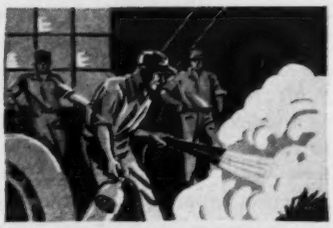
The Valve That Speeded-Up Carbon Dioxide Portable Fire Extinguishers *from fast to FASTEST*

Carbon dioxide has always been the fastest non-damaging fire extinguishing agent for use against certain types of fires. In originating the SQUEEZ-GRIP valve C-O-TWO now has ended the delaying action, loss of gas and waste motion of setting down a portable carbon dioxide extinguisher to operate a handwheel valve. The SQUEEZ-GRIP valve now makes possible the release of carbon dioxide gas against fire as fast as you can close your hand. The SQUEEZ-GRIP valve on all size C-O-TWO portables can be opened or closed instantly, while being carried. C-O-TWO SQUEEZ-GRIP is Safer—It's Faster.

FIRE



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Back at Work in 10 Minutes

C-O-TWO is a registered trade-mark and corporate name of this company. C-O-TWO is inspected and labeled by the Underwriters' Laboratories; approved by Factory Mutuals and the Bureau of Marine Inspection and Navigation. To be safe specify C-O-TWO.

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Sales and Service in the Principal Cities of United States and Canada

study of past and current sales of the company's industrial fasteners and pole line hardware as well as problems of future distribution and marketing.

▶ E. J. ARCHBOLD, electrical engineer with the Georgia Power Co., in Atlanta, has been appointed general design engineer to fill the vacancy caused by the recent death of William S. Beckett. Mr. Archbold has been with the company since 1927.

▶ FRANK S. KEELER, Alabama Power Co., has been promoted from division superintendent to Mobile district manager and assistant to the Mobile division vice-president, and EARL A. BENSON from assistant superintendent to superintendent of the Mobile division. J. T. NOLEN, JR., formerly Gadsden district superintendent, has been advanced to the position of southern division superintendent and M. A. LAMB from Gadsden district engineer to Gadsden district superintendent.

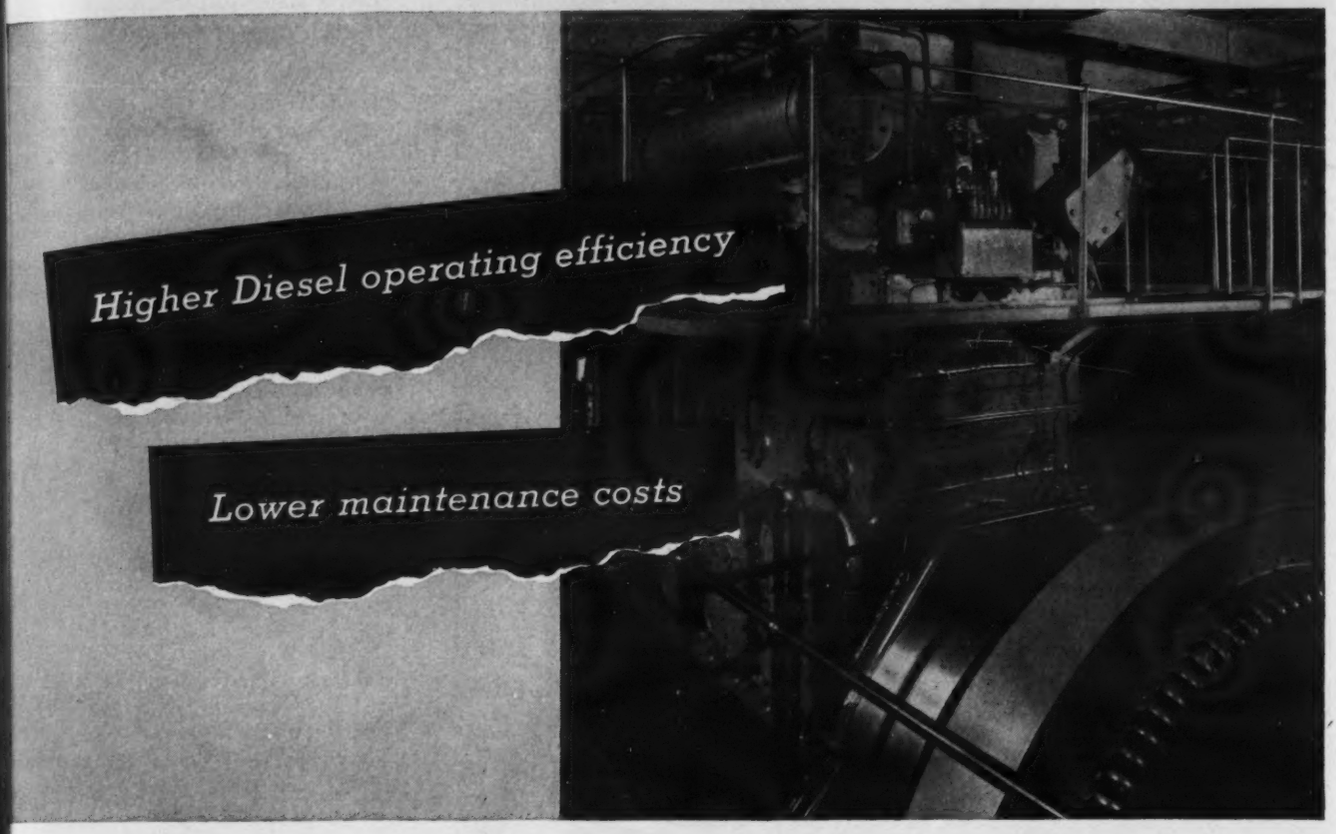
▶ JOE E. HARRELL, vice-president of the New England Telephone & Telegraph Co., Boston, Mass., and connected with the Bell telephone system in various capacities for the past 30 years, has been elected president of the company, to succeed JOHN J. ROBINSON, who retires on March 1, 1944, after 45 years of service in the system. BARTLETT T. MILLER, general commercial manager, succeeds Mr. Harrell as vice-president and CLYDE J. HEATH becomes general commercial manager.

▶ C. V. MCKAY, who for the past 2 months has been with the War Production Board in Washington, D. C., as assistant chief, wire mill branch, copper division, has become affiliated with the Triangle Conduit & Cable Co., Inc., New Brunswick, N. J., in the capacity of assistant to the president.

▶ J. ALBERT KEENE, formerly connected with the Public Service Electric & Gas Co., Newark, N. J., has joined the Alabama Power Co. as assistant superintendent of production. Mr. Keene has been identified with the New Jersey utility since 1927.

▶ KARL HORINE, head of materials testing division in the testing department of the Commonwealth Edison Co., has retired after nearly 34 years in the company. Succeeding Mr. Horine as materials engineer is LOUIS B. SCHOFIELD, formerly engineer, materials testing. Mr. Horine began his career with the Chicago utility in 1910 in the construction department and transferred to the testing department one year later as testing engineer engaged in cable fault location work. While handling this assignment, he began to develop material tests and specifications for materials used by the company, and in 192

Improved Lubrication with Gulf Parvis Oils pays dividends:



Gulf Parvis Oils are writing a list of definite benefits in the operating records of hundreds of Diesels. The list includes greater efficiency, lower maintenance costs, fewer shutdowns for repairs, and longer service life.

Here's the important reason for the outstanding performance of Gulf Parvis Oils: Built into these quality oils through constant research is *superior lubricating value*, insuring better protection to moving parts under today's peak load and overload operating conditions.

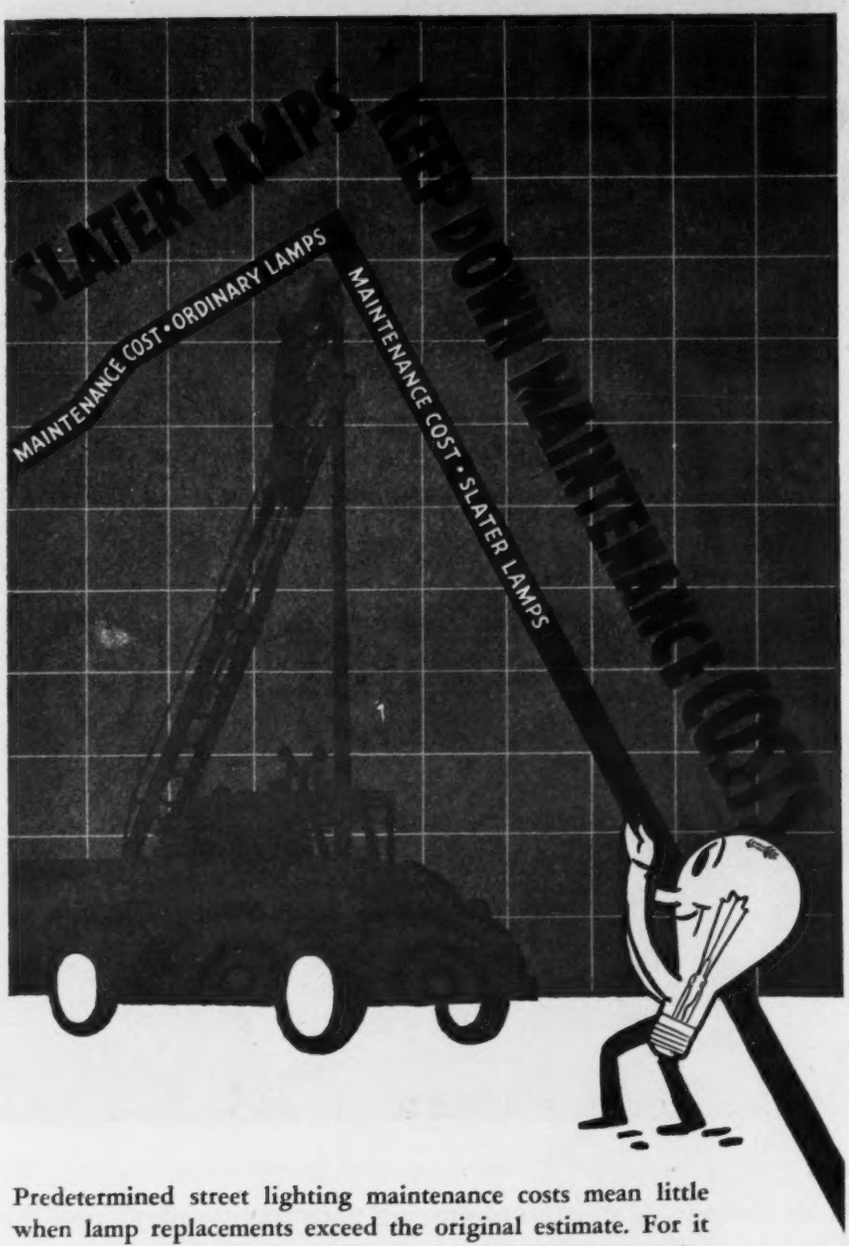
For effective help in improving the lubrication of *your* Diesels, call in a Gulf Lubrication Service Engineer and ask him to recommend the proper grade of Gulf Parvis Oil to fit your particular requirements. He has had broad practical experience with all types of Diesel engines. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

It will pay you to investigate—call in a Gulf Lubrication Service Engineer



Predetermined street lighting maintenance costs mean little when lamp replacements exceed the original estimate. For it is not the small expense of the lamps, but the extra maintenance involved which results in the costly upkeep. The cost of man-hours, tire and truck depreciation, waste of precious gasoline . . . extra trips . . . all increase maintenance charges far in excess of contract prices. And lamps that fail must be replaced so as to prevent night traffic fatalities which are now costing so many lives. . . . Because SLATER LAMPS are built to the highest standards they embody every feature which assures correct lighting and *long lamp life* with resultant long-term economy. Rigid tests and inspection keep them practically free from defects. That is why, when you specify SLATER, you can be assured of dependable performance and greater light output at lower cost, under all conditions. Catalog upon request.

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BROOKLYN, NEW YORK

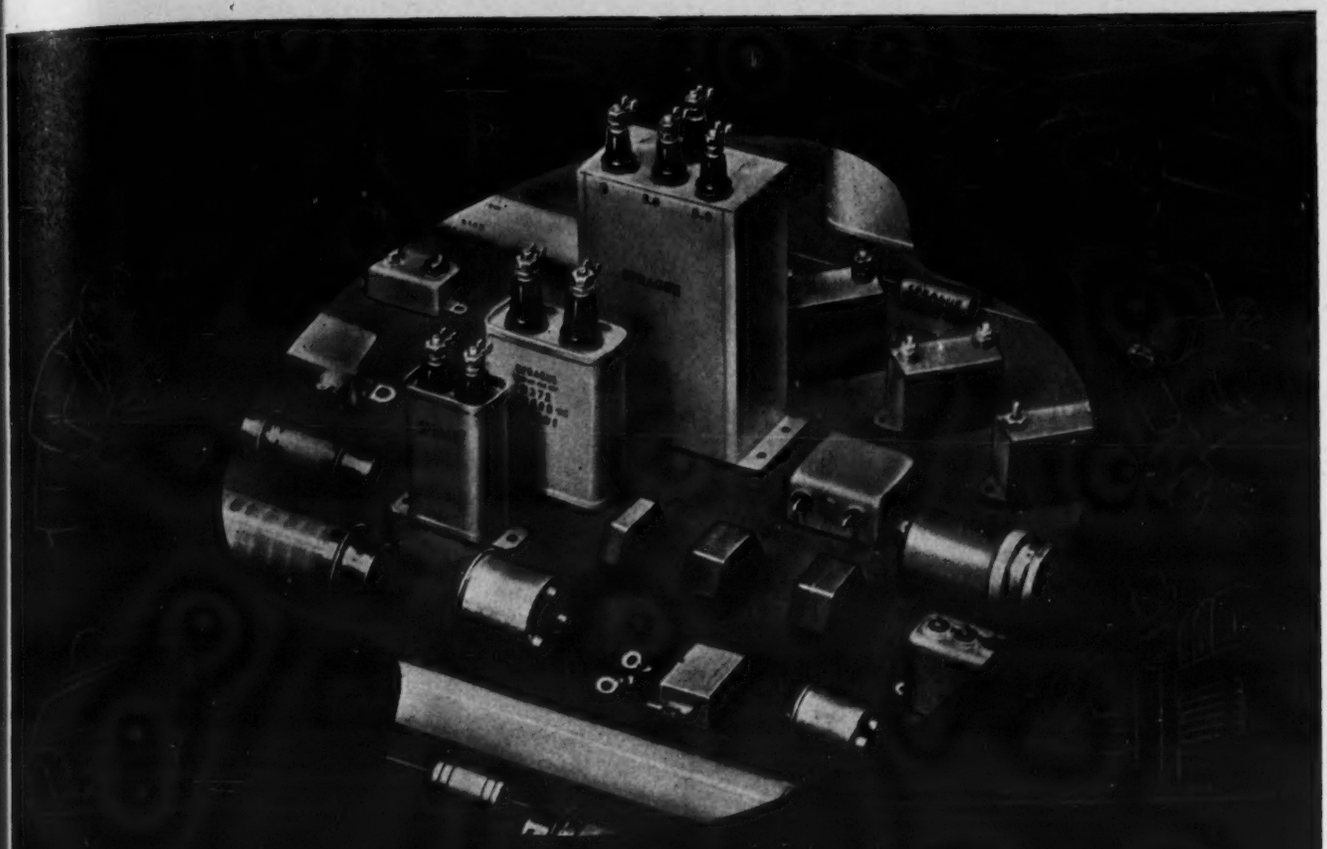
MANUFACTURERS OF STREET LIGHTING LAMPS, AND PRECISION ELECTRONIC TUBES

was promoted to the position of research engineer, materials testing division. Under his guidance this division has grown until its activities now cover the development of tests and specifications for practically all materials purchased by the company for construction and maintenance. Mr. Horine is a member of the American Institute of Electrical Engineers, the American Society for Testing Materials, American Society for Metals and American Electrochemical Society.

▶ EARLE WILDE, formerly load dispatcher for the Commonwealth Edison Co., Chicago, has been appointed assistant chief load dispatcher. Starting as an exciter operator at Northwest station in 1924, Mr. Wilde transferred four years later to the office of superintendent, generating stations. He has been a load dispatcher since April, 1930.

▶ RAY MURPHY, well known in the electrical industry of the West, where for more than 20 years he served as Pacific Coast manager for the Westinghouse Lamp Co., and more recently as sales promotion manager for the same interests at their Eastern executive offices, has returned to California, establishing his own business as manufacturers' representative for three nationally known manufacturers, Crescent Insulated Wire & Cable Co., Trenton, N. J.; Spang-Chalfant, "Central Conduit" (Division of the National Supply Co.), Pittsburgh, Pa., and Steel City Electric Co., Pittsburgh, Pa. Office and warehouse are located at 720 East Second Street, Los Angeles, Calif.

▶ PHIL H. PALMER, for many years in charge of operations of the Public Service Co. of Indiana in the Kokomo division, has retired. L. J. EVANS, formerly district manager at Wabash, has been selected to succeed him. In approving the retirement of Mr. Palmer the board of directors took cognizance of his 40-year record of "faithful and efficient services, and effective contribution to the development and expansion of the operations in the Kokomo area. . . ." A native of Iowa, Mr. Palmer entered the Indiana public utility field in 1904 as superintendent of light and power for the old Kokomo, Marion & Western Traction Co. After that company was merged into the Indiana Railway & Light Co., he became superintendent and later general manager, in which position he was serving when the Northern Indiana Power Co. was organized. In 1923 he became vice president of the Northern Indiana utility and through the ensuing operational plans of 20 years was always either in that position or the position of division manager for the Kokomo division. Mr. Evans joined the com-



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Sprague engineers have the answers to most capacitor problems, and the Sprague line matches most of today's exacting requirements.

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QUALITY COMPONENTS • EXPERTLY ENGINEERED • COMPETENTLY PRODUCED

BLACKBURN CONNECTORS

Give you these 5 FEATURES at no extra cost!

1. Made completely of a high-strength copper alloy, actually stronger than steel. Positively will not season-crack.
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3. All corners rounded — will not nick wires.
4. Machined to close tolerances.
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Builders of Quality Connectors for Over 10 Years

✓ ***Your planning aid to post-war progress . . .***

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Trailer engineering can make money for you, too, and in many ways. For instance by enabling full productive time of your crews, minimizing their waste time spent traveling to and from jobs, enabling them to give quicker service, having all their tools for the job, on the job, at the right time.

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MAN-HOURS SAVED. These Ben-Hur tool box trailers saved 15 minutes per man per day.

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INDUSTRIAL TRAILERS

pany as a salesman at Wabash at the age of 28. Subsequently he was transferred to Columbus and then to Kokomo. In 1936 he took over as district manager of Wabash on the retirement of Mr. Klare. During the past six months Mr. Evans has been at division headquarters as assistant to Mr. Palmer.

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G. E. Announces Changes at Pittsfield Works

Fred G. Stebbins has been appointed manager of sales, capacitor section, transformer division of General Electric, at the Pittsfield (Mass.) Works, succeeding Charles F. Miller, transferred to New York City as senior transformer specialist. Mr. Stebbins was graduated from Union College in 1918. He spent four years with International G. E., and in 1924 was transferred to the central station division. In 1930 he went to Pittsfield and was largely associated with the promotion of Pyranol transformers and network system transformers. In 1943 he was appointed assistant manager of sales, distribution transformer and feeder regulator sections. Melvin L. Hurni has been named to take over Mr. Stebbins' former duties and he will be in charge of the distribution transformer section in the absence of H. M. Jalonack.

Edward V. Dillon has been appointed assistant manager of sales in the feeder voltage regulator division, Pittsfield Works, G. E., a new position. He joined the company in 1910 in the transformer engineering division, and was engaged in design activities in connection with transformers from 1916 to 1925, following test work at Pittsfield. From 1925 to 1933 he was in the transformer commercial division. For the past decade Mr. Dillon has been engaged in the sale and promotion of feeder voltage regulators.

•

► CAMILLE BEAUCHAMP, for seven years home economist for Westinghouse in the southeastern district, has been appointed assistant director of the company's Home Economics Institute at Mansfield, Ohio. In her new position Miss Beauchamp's main duty will be to assist Julia Kiene, director of the institute, in the preparation of Health for Victory meal planning guides. Another responsibility will be the testing of such post-war appliances as automatic washers. Before the war Miss Beauchamp conducted cooking schools, demonstrated Westinghouse appliances and gave talks before home economics stu-

PIONEERING *in Hydraulics*

SENSING the potentialities of water as a source of power, S. Morgan Smith, our founder, applied his energies to its utilization.

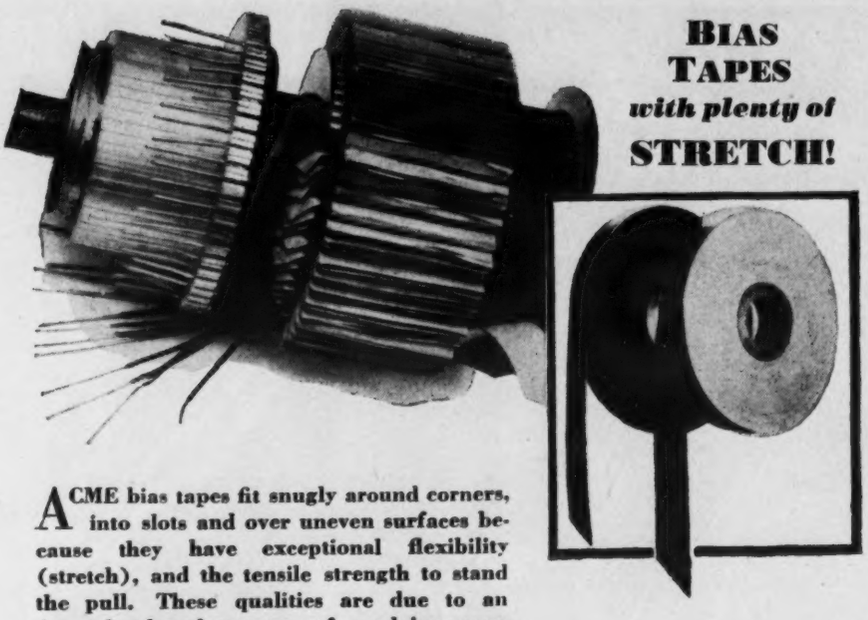
His pioneering effort in the development of one of the early water turbines to be built in the United States ended in success.

Shrewd men adopted the water turbine as a source of power in ever greater numbers. But S. Morgan Smith's pioneering spirit continued—a spirit still manifesting itself in our endless research and experimentation—factors in the future development of POWER!

If It's Hydraulics—Put It Up to Us!

S·MORGAN SMITH COMPANY
·YORK·PENNSYLVANIA·U·S·A·

POWER by SMITH



BIAS TAPES *with plenty of* STRETCH!

ACME bias tapes fit snugly around corners, into slots and over uneven surfaces because they have exceptional flexibility (stretch), and the tensile strength to stand the pull. These qualities are due to an Acme-developed process of applying pure vegetable oil varnishes of Acme formula to highest grade cotton fabric. Available in bias or straight tapes and rolls up to 36" wide—yellow or black. Samples if desired.

Acme Wire PRODUCTS

THE ACME WIRE CO.
NEW HAVEN, CONN.

VARNISHED INSULATIONS—MAGNET WIRE—COILS

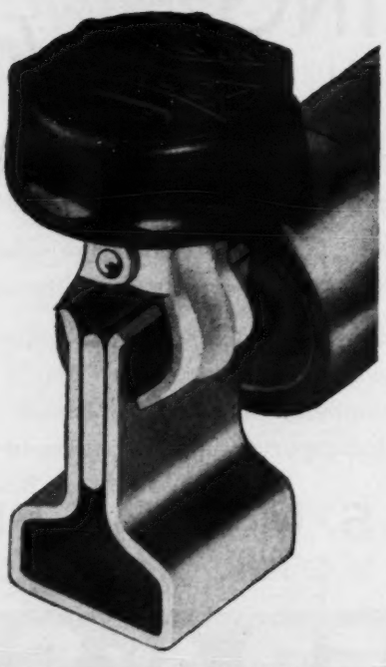
KLIPLOK Clamps

"Lock Like a vise"

SAVE
FUSES — CLIPS — POWER

TRICO KLIPLOK CLAMPS supply the needed pressure between fuses and clips. Destroying temperatures—premature fuse blowings—damaged clips—charred fuse casings—wasted kilowatts—lost production—idle machinery and workmen are eliminated.

TRICO KLIPLOKS are clip insurance, and their cost is quickly wiped out by the IMMEDIATE savings created. Should be used on all fuses, regardless of make. Made in ten sizes to fit all ferrule and knife blade styles and sizes of clips.



WRITE FOR BULLETIN #6

TRICO
REG. U. S. PAT. OFF.

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

dents and women's clubs. In 1942 she was assigned to full time industrial nutrition work.

•

American Steel Makes New Appointments

Bruce W. Bennett has been appointed assistant general manager of sales of the American Steel & Wire Co. In his new position Mr. Bennett will be in charge of the New York office of the company, succeeding Frederick Connell, who is retiring after 45 years association with the company. Born in Wilkes-Barre, Pa., Mr. Bennett first started working for the company in 1909, as a salesman in the electrical and wire rope department of the New York sales office. Five years later he was transferred to Wilkes-Barre as a salesman in the same department. In 1929 he was made manager of sales of the Wilkes-Barre office, the position he has held to the present time. Mr. Connell became associated with the Consolidated Steel & Wire Co., a predecessor of American Steel & Wire Co., in 1897. With the exception of a period of thirteen months he has worked for the Wire company ever since and has been assistant general manager of sales, with the New York office under his jurisdiction since 1936.

E. C. Ostlund has been appointed assistant chief industrial engineer of the company, with offices in Cleveland, Ohio, and Evarts C. Hall has been named works industrial engineer at South Works, Worcester, Mass., to succeed Mr. Ostlund. Both Mr. Ostlund and Mr. Hall started with the company in 1936.

Three personnel changes affecting the New Haven, Conn., operations and the metallurgical department in Cleveland have been announced. Robert Murray has been appointed assistant division metallurgist in Cleveland. Edwin E. Caspell has been named superintendent of the New Haven works, succeeding Mr. Murray, while Arvin P. Wiedemann has been made general foreman of the rope mill at New Haven, replacing Mr. Caspell. Mr. Murray first became identified with American Steel in 1920 and has been superintendent at New Haven since 1941. Mr. Caspell worked for various Cleveland plants of the company for numerous short periods while attending the University of Cincinnati. Upon graduation, he became permanently associated with it. Mr. Wiedemann has been with the organization for the past six years.

•

▶ A. J. Soper has retired as district manager of the Northern Electric Co. for Quebec. A graduate of McGill Uni-

Crystal

GLASS

. . . the best material available for scientifically-correct ILLUMINATION

CRYSTAL PRESSED GLASS is the *one* material that has all the inherent qualities to make it the best medium for modern illumination...

Because

- **IT IS CRYSTAL CLEAR** (will not discolor)
- **IT IS WATER REPELLENT** (and *stays* that way)
- **IT IS SCRATCH RESISTANT** (impervious to abrasion)
- **IT WILL NOT WARP**—even at high temperatures

HOLOPHANE has developed and perfected economical, efficient and permanent lighting units—based on the advantages of prismatic crystal glass. Consult Holophane engineers without charge or obligation. Their services are offered *not* in competition with those of architects or engineers, but are supplementary to their advice.

HOLOPHANE COMPANY, INC. . . . *Lighting Authorities—Since 1898*

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Holophane Co., Ltd., 385 Yonge St., Toronto, Can.

Because good lighting and the saving of manpower are so unmistakenly linked we have contributed to and are cooperating with the WAR PRODUCTION FUND TO CONSERVE MANPOWER.

VICTOR INSULATORS INC

VICTOR, NEW YORK

V

The Mark of Good Insulators...

ELECTRITE

A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

DENSITE

An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department

WEST VIRGINIA PULP & PAPER COMPANY

230 Park Avenue, New York, N.Y. 35 E. Wacker Drive, Chicago

Test Insulation the Modern Way with a MODEL B-5

MEGOHMER

NEW BATTERY-VIBRATOR TYPE

No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

VARIOUS NEW MODELS AND RANGES

HERMAN H. STICHT CO., INC.

27 PARK PLACE NEW YORK, N. Y.

WRITE FOR BULLETIN No. 430

versity, Mr. Soper joined the Imperial Wire & Cable Co. in 1911. Two years later he was appointed manager of the company at Toronto, and when, in 1914, that firm amalgamated with the Northern Electric, he continued in that position until 1917, when he was appointed district manager at Montreal, with jurisdiction throughout the Province of Quebec. This position he occupied until his recent retirement.

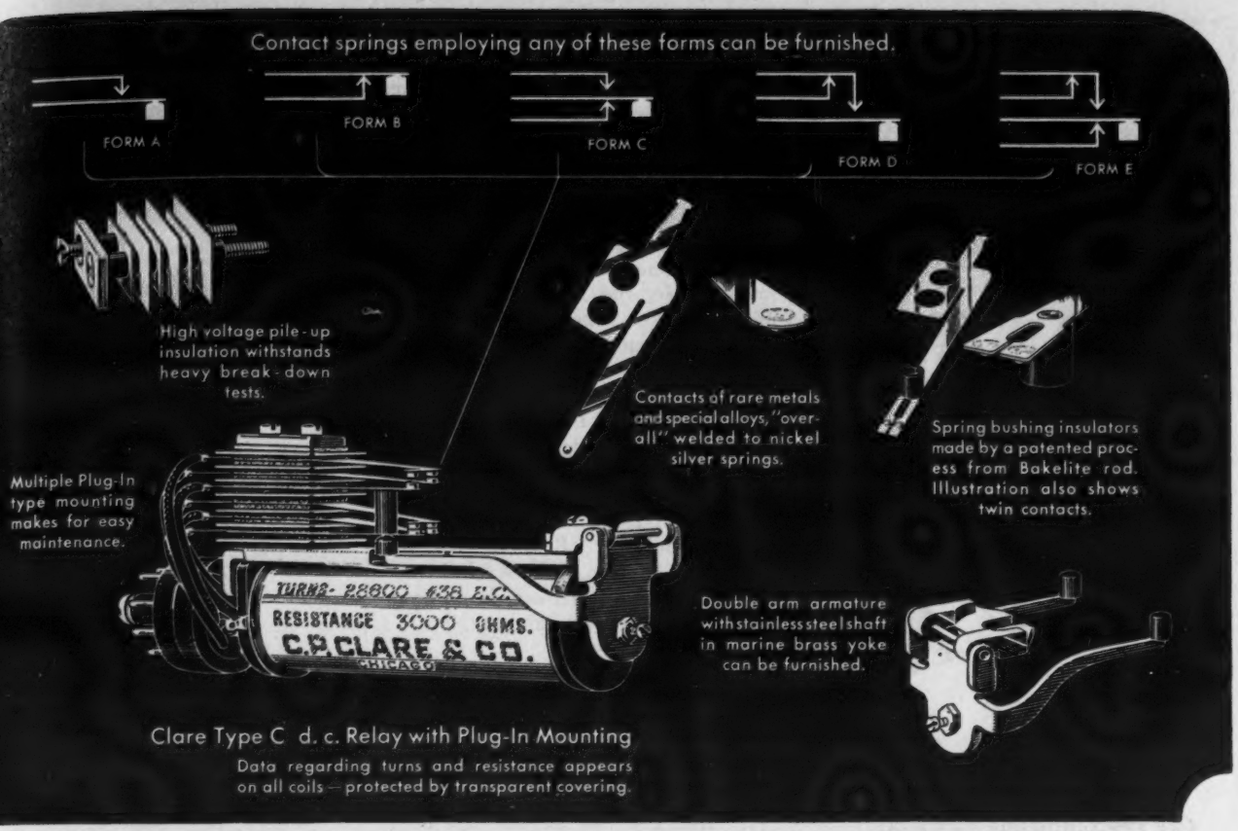
► ROLAND WHITEHURST, assistant sales manager of the Electric Storage Battery Co. since 1940, has been assigned the title of sales manager. Mr. Whitehurst has been in the employ of the company since 1908, and was manager of its Washington branch for 20 years.

► FRANK R. BENEDICT, for the past two years New England district engineering and service manager for the Westinghouse company, has been named head of a newly created division of the district engineering and service department with headquarters at East Pittsburgh, Pa. The division will correlate field experience with equipment for the benefit of users and manufacturing engineers. Mr. Benedict was graduated in 1928 from the company's student course and was on the staff of the chief engineer at East Pittsburgh for some time before going to New England. He has been succeeded at Boston by FRANK P. TAUGHER, formerly southwestern district engineer and assistant to the manager of the St. Louis area.

► THOMAS F. SCANNELL has been appointed general sales manager of the Falk Corp., Milwaukee, Wis. In his new capacity Mr. Scannell will be responsible for the sale of all Falk products, including steel casting. Prior to his new appointment, he was sales manager for all Falk products with the exception of those coming under the jurisdiction of the foundry division. Heretofore foundry sales and operations have been under the direct supervision of Arthur Simonson, vice-president, who has specialized in steel foundry production and sales with the Falk Corp. for the past 35 years. JOHN S. WILKINSON, who has been connected with the Falk foundry in various capacities for many years, will function as assistant sales manager in charge of foundry sales.

OBITUARY

► HENRY STEPHENSON, Edison Pioneer, who played a large part in the evolution of the New York Edison distribution system from the days of the Edison Tube to 1925, when he retired as superintendent of New York Edison Co. distribution, died at his home in Portland, Me., on December 4. Immediately after leaving grammar school in 1881 he


Contact springs employing any of these forms can be furnished.
FORM A
FORM B
FORM C
FORM D
FORM E
High voltage pile-up insulation withstands heavy break-down tests.
Contacts of rare metals and special alloys, "overall" welded to nickel silver springs.
Spring bushing insulators made by a patented process from Bakelite rod. Illustration also shows twin contacts.
Multiple Plug-In type mounting makes for easy maintenance.
RESISTANCE 3000 OHMS.
C.P.CLARE & CO.
Double arm armature with stainless steel shaft in marine brass yoke can be furnished.
Clare Type C d. c. Relay with Plug-In Mounting
Data regarding turns and resistance appears on all coils — protected by transparent covering.

Clare Type "C" Relays For Pilot and Supervisory Systems

wide range of utility applications are filled by the Clare Type "C" elay. This simple, rugged, multiple contact relay is first choice for ots where hard service, long life and absolute dependability are of ime consideration.

he Clare Type "C" Relay is especially valuable for use in operating ontrol panels, supervisory control boards and load dispatching cenrs where signals are indicated from remotely located switches, cirit breakers, network protectors and other equipment.

nnumerable contact arrangements are possible with the Clare Type C". Its standard spring assemblies may be equipped with any comination of the forms shown above. Twelve different standard, or ther special, types and sizes of contacts may be provided.

he Clare Type "C" Relay may be "custom-built" to meet the exact equirements of the application for which they are required. Proper ountings are available for every application. Let our engineers know our specific relay problem. Catalog and data book will be sent on equest. C. P. Clare & Co., 4719 Sunnyside Ave., Chicago (30), Illinois. ales engineers in all principal cities. Cable address: CLARELAY.

Features of Clare Type "C" Relay

1. Contacts are made from precious metals and alloys, such as silver, palladium, palladium-irridium, tungsten and elkonium. They can be furnished in sizes from .062" silver, rated at 1 ampere, 50 watts, to .1875" tungsten, rated at 4 amperes, 500 watts. Various types can be incorporated in one relay.

2. Pile-up assembly is locked together under hydraulic pressure. Projecting wafer insulators which provide creepage path of ¼" between contact springs can be furnished. The entire assembly withstands very heavy breakdown tests.

3. Heelpiece, coil core and armature assembly are of magnetic metal, carefully annealed. Where sensitivity and timing are important factors, a *special magnetic* metal is recommended to provide permeability.

4. Spring bushing insulators of Bakelite rod give excellent service where heavy contact pressures are employed, where vibration exists, or heavy duty service is desired.

5. Coils are carefully wound to exact turns on precision machines. Lead out wires are securely soldered. Coils impregnated with special varnish are available. The coil is protected with a transparent acetate covering.

6. Relay illustrated is arranged for octal base plug mounting which makes for easy service and replacement. Other types of mounting, such as individual angle bracket, strip or panel can be furnished. Easy to handle slip-on Bakelite covers for individual mounting or metal covers for group mounting can be supplied.

L A R E R E L A Y S

stom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

Fire cannot burn without air. With swift efficient action *CD/Fog* completely surrounds fire with a blanket of carbon dioxide. *Air is sealed out.*

CD/Fog is especially recommended for oil, gasoline, electrical, or chemical fires. Built by General Detroit, manufacturers of fire protection equipment since 1905, *CD/Fog* comes from a distinguished line of fire fighters, including such famous names as Fire Guard, Alaskan, and Floafome. Like all General products, it is quality mass produced for prompt delivery to essential users.

Find out about *CD/Fog* today! Mail the coupon and details will be rushed!

THE GENERAL DETROIT CORP.

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NEW YORK DETROIT CHICAGO

Distributors in all principal cities

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THE GENERAL DETROIT CORP.
2208 East Jefferson Ave., Detroit 7, Mich.
SPEED complete details to:

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Just attach this convenient coupon to your letterhead and mail.

signed up as a mechanic apprentice. Four years later he got a job testing dynamos at the famous Edison Machine Works in Manhattan, and after being transferred to the Brooklyn plant he was sent out on jobs of installing the Edison tube in various American cities. Later he went to Schenectady, and then followed his appointment as underground foreman and subsequently superintendent for the Edison Electric Illuminating Co. When Edison Electric Illuminating merged with the New York Edison Co. Mr. Stephenson was placed in charge of the underground and wiring departments. In 1902 he was appointed superintendent of distribution for New York Edison.

▶ JOHN G. IVES, service manager of the Edison Storage Battery Division, Thomas A. Edison, Inc., West Orange, N. J., died, of a heart attack, on January 3, in his forty-seventh year.

▶ DEAN H. GALLAGHER, engineer, Essex Division, electric distribution department, Public Service Electric & Gas Co., Newark, N. J., died suddenly on December 18. A native of Syracuse, N. Y., and a graduate of Cornell University, Mr. Gallagher entered the employ of Public Service in 1921 as a cadet engineer. In 1924 he was assigned to the Essex Division, electric distribution department, and continued in that connection up to the time of his death.

▶ RICHARD B. MATTHEWS, prominently identified with the electrical industry in Great Britain, died on August 21, at the age of 67. A native of South Wales, Mr. Matthews obtained his education in London at the Royal College of Science and the Central Technical College. After serving his apprenticeship with the Milbrook Iron & Steel Co., Swansea, he became identified with Robert Blackwell & Co. and then obtained a departmental appointment with the General Electric Co. in this country. Later he became electrical engineer at Amsterdam, N. Y., for the Edison Electric Light & Power Co. Returning to England, he began to practice as a consulting engineer. Mr. Matthews was active in the affairs of the Institution of Electrical Engineers (Great Britain), having served in 1934-35 as chairman of the transmission section. He was a member of the Electricity Commissioners' Rural Electrification Conference and chairman of the Rural Reconstruction Association. On his 640-acre farm near East Grinstead he experimented extensively, claiming that there were at least 67 ways in which electricity could be applied to farming activities. He was a director of the Electrical Press, Ltd., edited *Electro-farming*, and was also a frequent contributor to technical journals.

RELIABLE CAN HELP YOU

SAVE TIME

in speeding the wo program by usin Reliable Straightlin splices on new co struction and o maintenance.

SAVE COPPER

by using these pe fect joint makin units over and ov again.

RELIABLE

STRAIGHTLIN SPLICE

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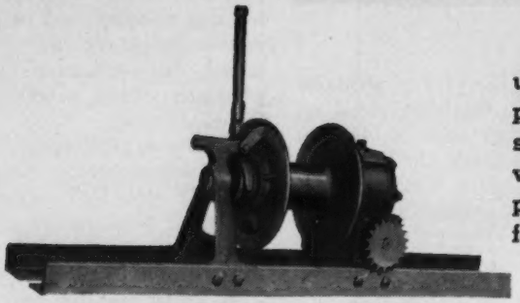
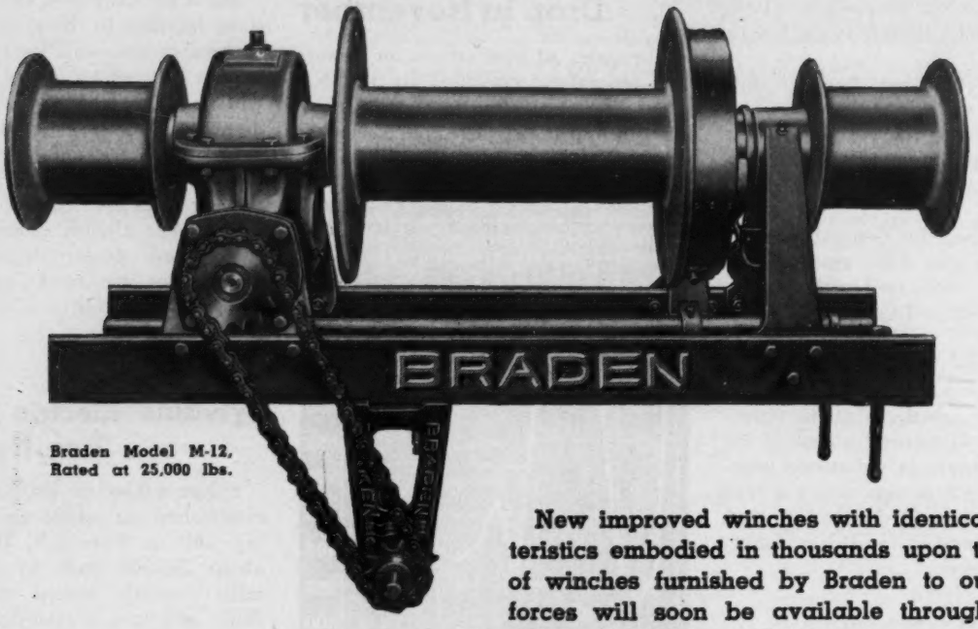
Reliable ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITY
2345 CARROLL AVENUE · CHICAGO

WATCH FOR THE NEW LINE OF BRADEN'S BETTER WINCHES



Braden Model M-2, Rated at 5,000 lbs.

This model particularly adaptable to the pick-up truck to meet emergencies and for rural line patrol service. Excellent equipment for light pole setting, transformer handling and other power winch requirements in connection with light and power service. This size winch also available for front and under-body mounting.



Braden Model M-12, Rated at 25,000 lbs.

New improved winches with identical characteristics embodied in thousands upon thousands of winches furnished by Braden to our armed forces will soon be available through Braden Winch distributors all over the western hemisphere.

BRADEN WINCH COMPANY
Tulsa, Oklahoma

Our 20th Year of Service

BRADEN

MANUFACTURING-MARKETS

G.E. Last Quarter Orders Drop 76%

Announcement has been made by the General Electric Co. that more than $450,000,000 of its orders had been canceled in 1943, and that orders received in the last three months of the year were 76 percent less than those of the corresponding quarter of 1942. Orders for the last quarter dropped to $160,739,000 from $663,590,000 in the fourth quarter of 1942.

This sharp reduction, however, left the company with unfilled orders on hand at the end of the year equivalent to a year's output at current production rates and prices, Gerard Swope, president, said.

Orders received by General Electric for the entire year 1943 amounted to $1,360,643,000, compared with $2,003,039,000 for 1942, a decrease of 32 percent.

The trend was revealed by figures issued for each quarter, as follows: For the first three months of 1943 orders received were 41 percent ahead of the same 1942 quarter; in the second quarter orders were 8 percent under a year earlier; for the third quarter they dropped 45 percent and the fourth quarter, 76 percent.

•

Emerson Electric Sales Reach Peak

"An extraordinarily large amount of peacetime business" has been booked by the Emerson Electric Manufacturing Co., W. S. Symington, president, declared in discussing the company's post-war planning program in the annual report issued recently.

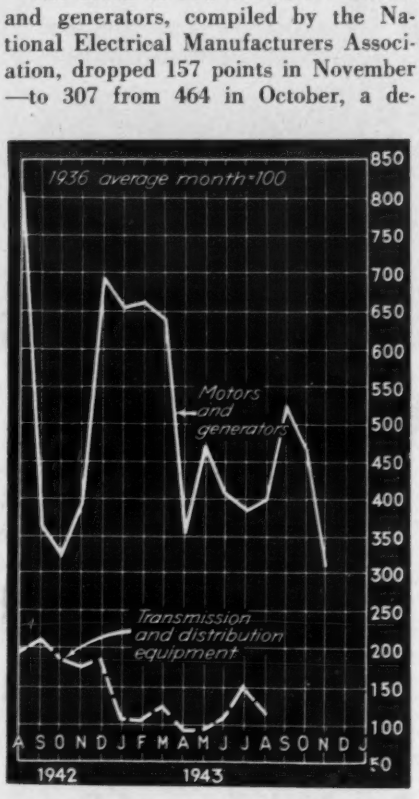
Bomber-turret production was described as most responsible for the company's record sales of $83,207,190 for the fiscal year ended on September 30, last, which compared with the previous peak volume of $52,869,704, in the 1942 fiscal year. Deliveries of the electrical division, representing the company's normal activity, exceeded its sales for any previous year, Mr. Symington pointed out.

Net income for the year of $898,658 was equal, after preferred dividend requirements, to $2.01 each on 417,120 shares of common stock. In the previous year the company had a net of $671,166, or $1.57 a common share.

•

Generators Orders Drop in November

The index of new orders for motors and generators, compiled by the National Electrical Manufacturers Association, dropped 157 points in November —to 307 from 464 in October, a decrease of 34 percent. It compares with 395 for November, 1942, a decrease of 88 points, or 22 percent.



NEMA INDEX, value of orders received

Compilation of the figures for the index of orders received for transmission and distribution equipment has been discontinued for the present due to the suspension of certain monthly statistical activities affecting several of its components. The index will be resumed when complete data are again available.

Sees Rising Output for Appliances

Electrical manufacturers will produce from 500,000 to 1,000,000 refrigerators for civilian use during 1944, Charles G. Pyle, managing director of the National Electrical Wholesalers Association, recently stated. Mr. Pyle also predicted that a like number of electric washing machines will be placed on the market before the end of the year and added that indications pointed to a gradually rising production in these items.

Discussing the recent authorization by the government of the production of 2,000,000 electric irons this year, he declared: "I have absolute confidence that manufacturers and wholesalers will be able to overcome all reconversion and distribution problems and will meet that quota in full."

Mr. Pyle expressed the opinion that some increase in the output of electric cooking ranges could be looked for, and added: "It seems probable that there will be at least 88,000 electric ranges manufactured instead of the 64,000 called for in previous plans."

He believes that the reconversion of the electrical industry to peacetime production has already begun on a small scale, and declared that electrical wholesalers are rendering substantial aid in distributing available products.

•

Sylvania Electric Opens Two New Plants

Sylvania Electric Products, Inc., has established an additional manufacturing unit at Dover, N. H., occupying about 250,000 sq.ft. of space in two mills formerly owned by the Pacific Mills and now owned by the city of Dover.

The company recently completed a new electrolytic plant at Williamsport, Pa., where war-needed electronics devices are being speeded. At a cost in excess of $150,000 a red brick structure was built under Sylvania supervision and equipped with 108 electrolytic cells, high-powered compressor machines, low-pressure and high-pressure storage tanks and a distillery to supply the large quantities of chemically pure water which is processed into the two gases.

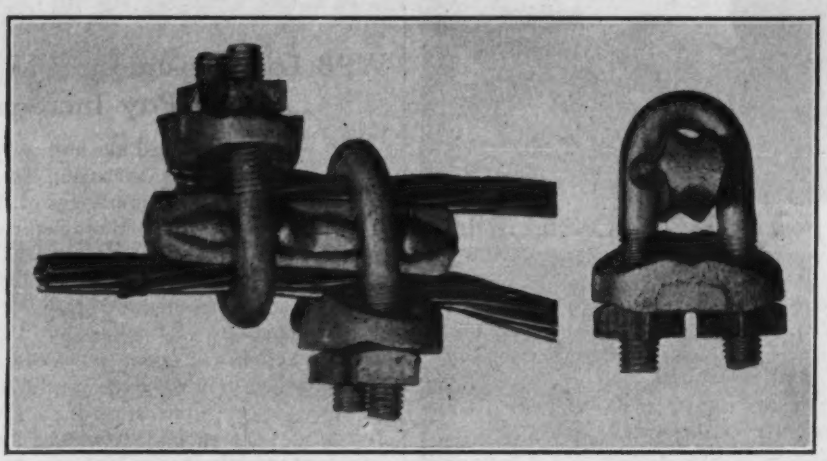
•

Cash-Award Plan Revised

Western Electric Co. has changed its previous system of providing cash awards for adopted suggestions relating to any phase of the company's opera-

Now Ready—M. I. F. Improved Guy Clamps

These new M.I.F. Guy Clamps provide typical "come-along" grip of greatly increased efficiency and minimum injury to strands, resulting from the insertion of a Separator provided with V-grooves between the load strand and the tail strand, and with trunnions on which the U-bolt may pivot as the load on the strand passes its elastic limit, thereby re-setting the Clamp for emergency overload on the strand. Principal characteristics of these Clamps are listed below:



At left, test sample PAX69 Clamp after breaking 1/2" (7x6) 30% E.HS. Copperweld Strand at 22,670 lbs. At right, typical PAX67 Clamp, end view.

To Current Users of M.I.F. Through-bolt Guy Hooks, etc.

We give our assurance that these new Guy Clamps will perform to equal advantage and with equal economy. To others, we merely suggest—*investigate both groups*—a trial installation will convince you.

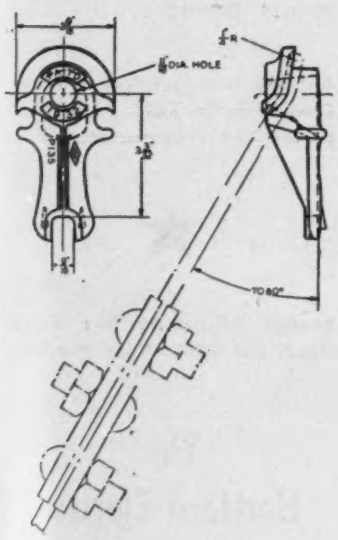
Coming—a smaller size similar Clamp with possibilities for use on conductor dead-end loops also, and as a connector.

Prices

PAX67 Clamp @ $24.50/C., net, and PAX69 Clamp @ $47.60/C., net, F.O.B. Branford. Shipping weights approx. 120 lbs./C., and 230 lbs./C., resp. Lower unit prices apply for larger quantities, and we will accept one initial trial order for any smaller quantities of either Clamp, or assortments, at the 100-lot prices listed.

Or, we will send sample PAX67 Clamp without charge or obligation to construction men of Operating Companies requesting same on Company's letterhead.

We aim to have the field performance of the Clamps do the selling, rather than anything we can say about them.



Ultimate Rating

Single PAX67 Clamp, 10,000 lbs. Double PAX69 Clamp, 20,000 lbs. Tests in laboratories of three leading producers of guy strands and by several Operating Companies have confirmed these ratings by breaking strands with negligible slip at loads exceeding ratings by at least 10%. Breaks were good tension breaks with efficiency of the clamping averaging over 97%, expressed as ratio of test performance of strand loop with Clamp to actual strength of same strands tested in straight line beween two closed-end sockets, into which strands had been secured with molten spelter.

Safe Working Load

Determined by elastic limit of strand used rather than by strength of Clamp itself, but generally 60% to 70% of rating of strand.

Capacity

PAX67 Clamp accommodates strands from 1/4" diam. to 1/2"., incl. PAX69 Clamp fits strands from 5/16" diam. to 1/2" diam. incl.

Specifications for Use

One PAX67 Clamp at each clamp location for 3M, 6M and 10M strands ranging from 1/4" diam. to 1/2" diam., incl. One PAX69 Clamp, or two PAX67 Clamps, at each clamp location for 16M and 20M strands ranging from 5/16" to 1/2" diam., incl. Or the change to heavier clamping might be made with the 10M strand if preferred, particularly where thimble for guy loop is porcelain rather than metal.

Clamping Plate of PAX67 Clamp should be placed leading on load side of loop with tail of loop between U-bolt and Trunnion Plate separating load and tail strands. Two PAX67 Clamps may be installed in series in same relative position, perhaps simplifying use of guy guard, but with PAX69 Clamp the second U-bolt is set opposed to insure maximum holding power on tail of the loop.

Nuts should be tightened to approx. 80 ft. lbs. torque, well within range of field practice with standard 10" and 12" wrenches, with U-bolts squarely across the strands. Then, as emergency loading stresses strands above their elastic limits, the U-bolts pivot on the trunnions on the Separator Plate (patented feature), causing the Clamping Plates to re-set themselves with negligible slip, thereby greatly increasing their holding power as compared with guy clamps without this self-tightening feature.

MALLEABLE IRON FITTINGS COMPANY

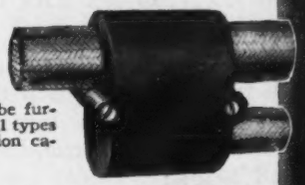
Pole Hardware Dept. [Factory and New England Sales Office] **Branford, Connecticut**

New York Sales Office: Thirty Church Street
Canadian Mfg. Distributor:
LINE & CABLE ACCESSORIES, Ltd., Toronto

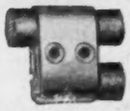
from the MOST COMPLETE lin
of Cable Taps

Now you can select from a really *complete* line of standard and special taps. Every one carefully designed and manufactured.

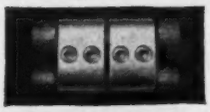
Parallel and 90° taps — and combinations — in the widest variety. For conductor sizes up to 1,000,000 CM.



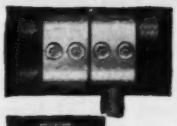
Gutter Tap with Bakelite Cover. Insulating covers can be furnished for all types of Penn-Union cable taps.



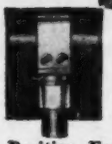
2-way Gutter Tap. Main and branch sizes 8 to 1,000,000.



Two Separate Parallel Taps to a continuous main conductor.



Combination Cable Taps; one branch parallel to main, and one at 90°.



Hinged Clamp of Penn-Union Type HFM makes installation easy. Multi-slit tapered sleeve assures permanent grip on branch.

Positive Equalized Pressure on main and branch, with Penn-Union Type SM. Tightening torque is accurate measure of the clamping force.

Also the *most complete line* of Service Connectors — Terminals — and thousands of other fittings, for all requirements.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

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Conductor Fittings

tions. Where the application of an idea will result in measurable savings the award will be 10 percent of the savings in material and labor estimated to result during the first year's operation. Prizes will be computed to the nearest $5 and will range from a minimum of $5 to a maximum of $1,000.

•

WPB Lets Westinghouse Give Pay Increase

The War Labor Board has authorized weekly pay increases averaging $4.42 for 13,000 supervisory employees of the Westinghouse Electric & Manufacturing Co. and five subsidiary companies to cover time and one-half compensations for work over forty hours a week.

Announcement was made by WPB that the action was taken to remove an "inequity" existing since the employees, because they received more than $200 a month, were exempt from the Fair Labor Standards Act, which required overtime pay for more than forty hours a week.

•

Allis-Chalmers Sponsors Boston Symphony

The weekly broadcast concerts of the Boston Symphony on the Blue Network shifted to the hour-length period on Saturday, December 25, beginning at 8.30 p.m., EWT, when the Allis-Chalmers Manufacturing Co. assumed sponsorship of the orchestra. Previously, the series was heard on a sustaining basis at 8.15 p.m., EWT. The symphony broadcasts will be heard regularly under the Allis-Chalmers aegis at the same time, Saturday, from 8.30 to 9.30 p.m., EWT, on the complete Blue Network of approximately 170 stations.

•

Army-Navy "E" Awards

Among the industrial plants recently announced as winners of the Army-Navy production award was the Square D Co., Kollsman Instrument Division, jewel bearing plant, Suffern, N. Y.

The third "E" award has been granted to the H. M. Harper Co., Chicago.

•

Stockholders Increase

Stockholders of the General Electric Co. numbered 229,058 on December 28, compared with 221,501 on December 28, 1942, W. W. Trench, secretary, has announced.

Second to None!

In a recent survey of nine great war manufacturing centers, Hartford's industrial load was three times that of 1939. An increase which is greater than that of any of the other areas surveyed.

At the same time, there has been no curtailment of essential civilian use and prewar price levels are still in effect.

Business management plus responsible, loyal men and women who know their jobs have made these accomplishments possible.

Aid The National Conservation Campaign To Save Fuel, Manpower And Transportation.

★

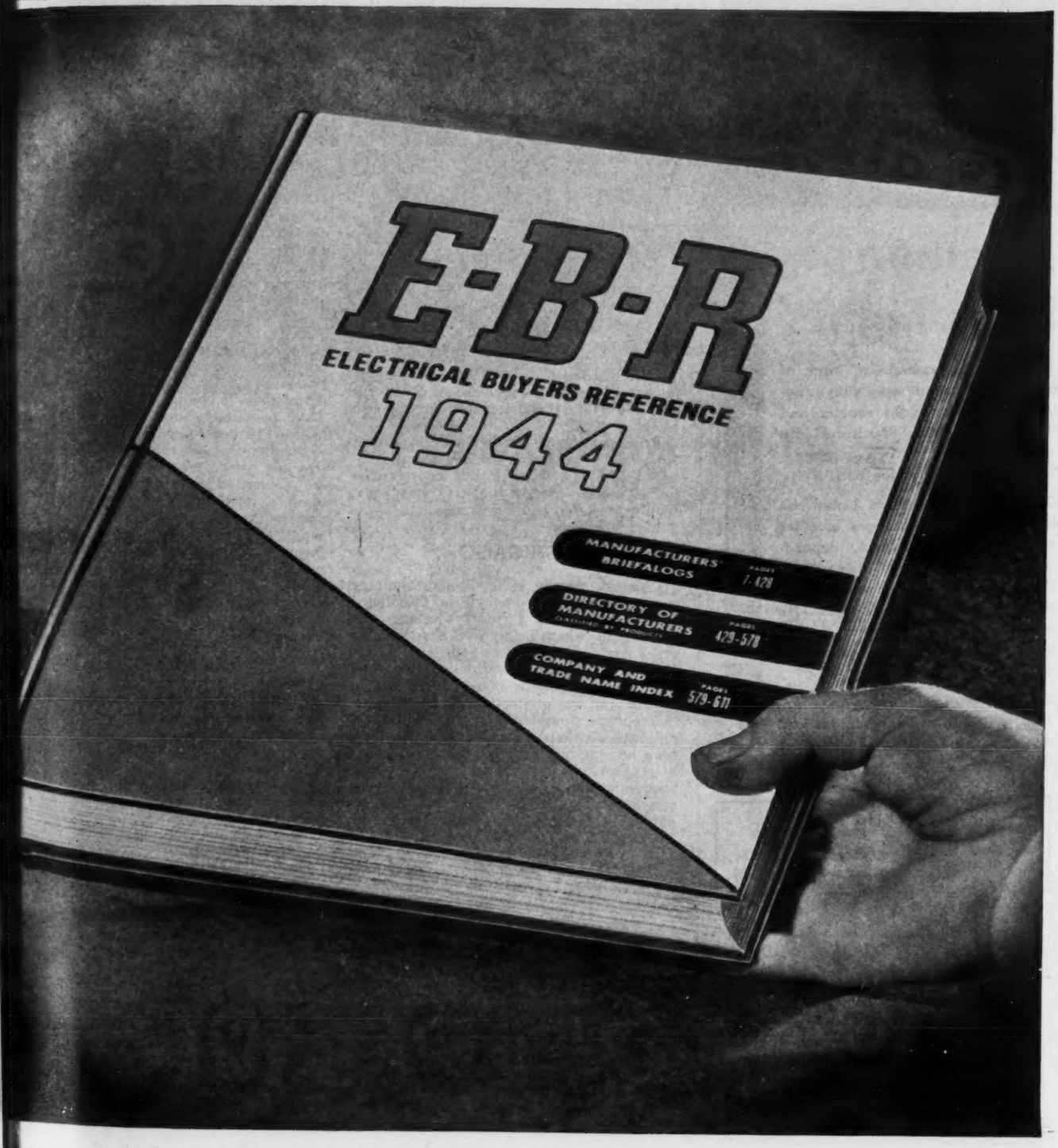
Enough Electricity For Every Need, But NEED What You Use.

The Hartford Electric Light Company

612 PAGE BOOK to help
in specifying electrical
allied products.

Just published!

Keep your copy handy
and use it throughout 1944



for NIGHT REPAIRS and LINE PATROL

Linemen's Flare Lights

An efficient, economical form of portable illumination—giving daylight vision for night repairs and line patrol work. Unaffected by wind, rain or snow. Two sizes—20 or 30 minute lighting periods.

Central Linemen's Flare Lights are invaluable during outages or other emergencies when quick, dependable illumination is imperative. Easily lighted in any weather by self-contained friction cap. No matches required. Stick in a post, tree, cross arm, in the ground or carry by hand.

They're always ready, and provide ample illumination. Standard equipment with prominent utilities throughout the land.

STANDARD PACKING

No. 3020—20 min., per case of 72...$12.00
No. 3030—30 min., per case of 36... 9.00

Central Railway Signal Company, Inc.

272 Center Street
NEWTON, MASS.

Plant Locations: Hammond, Ind.; Needham Hts., Mass.

Field Reports on Business

Post-war construction programs are being prepared on a large scale throughout the country. War housing continues to be a major construction item at the present time. The trend of business is upward, with most of the outstanding heavy industries showing gains.

NEW YORK

In the New York and Brooklyn areas department store sales declined 11 percent in the week ended January 8, according to preliminary estimates of the Federal Reserve Bank of New York. For the four weeks ended the same date sales dropped 1 percent. On a country-wide basis sales were down 3 percent for the week ended January 8, compared to the like week a year ago, according to weekly figures released by the board of governors of the Federal Reserve Board. Despite increasing difficulties in securing replacements, stocks were found generally to have held up fairly well with the aid of substitutes.

After falling sharply in the second half of December, business in the Pittsburgh district showed a pronounced gain last week, according to the Bureau of Business Research, University of Pittsburgh. Decided improvement was reported in nearly all lines of economic activity, the larger increases being in bituminous coal production and in originating shipments.

Civil engineering construction volume in continental U. S. totals $98,680,000 for the week, according to the *Engineering News-Record*, and is 357 percent above a week ago and 86 percent above the total for the corresponding 1943 week.

The current week's volume brings the 1944 construction to $120,277,000 for the two-week period, an increase of 3 percent over the $117,041,000 reported for the two weeks of 1943.

Private construction declined 28 percent from last week, but is up 79 percent compared with last year. Public construction is 549 and 86 percent higher, respectively, than a week ago and a year ago.

CHICAGO

Chicago, already a No. 2 labor shortage area, paradoxically enough is threatened with being named a No. 1 shortage area at a time when manpower shortages in other parts of the country appear to be easing. Explanation lies in the fact that Chicago was perhaps nine months late in getting into war production. Labor requirements have, therefore, lagged behind the nation somewhat. In Chicago of late they have become increasingly serious as certain huge west-side war plants have come into production and additional contracts been awarded. The labor supply has not expanded. One large plant with requirements of 30,000 to 40,000 workers is not yet in full production.

If Chicago is to be named a No. 1 area the switch is expected to go into effect February 1; however, reclassification has not been decided upon as yet.

The first few weeks of 1944 are bringing reports of several fairly sizable utility construction projects that are pending. Official announcement is being withheld by utility officials, most of whom are now in the midst of negotiations with WPB for equipment allocation.

Electrical manufacturers here, conscious of the presence of these projects, continue to report, however, that current utility bookings are stable at extremely low levels. Much of their present production is confined to electrical equipment for lend-lease. However, most of the informed manufacturers admit that the potentials for increased bookings in the next few months are promising, but lie entirely with WPB.

NEW ENGLAND

The Massachusetts post-war construction program provides for enormous outlays of money for highways, bridges and by-passes for heavy traffic through congested areas, improvements to the Logan Airport, East Boston, now owned by the state, and the purchase of harbor frontage later to be extensively developed for domestic and foreign trade.

A site has been selected for a war memorial to be erected by the city of Boston, funds for which, amounting to $1,000,000, have already been set aside. This will be a tower structure which will require special exterior and interior lighting. The New Haven R.R., now having ten 2,000-hp diesel electric locomotives built for both passenger and freight service, plans to add ten similar units. The Oscar Mayer Co., Madison, Wis., has been equipped with Sturtevant heaters and fans for meat-curing processes. Pittsfield (Mass.) works of the G.E. has installed a new "make-up" exhaust ventilating system in the tube rolling section of the plant to evacuate fog and toxic fumes. Plymouth County Electric Co. has received permission to build a 1.5-mile, 3-phase, 22-kv. pole line to furnish additional service to the Plymouth Cordage Co. plant.

Bidding for war contracts was more active last week. Massachusetts manufacturers submitted bids for electric heaters, blowers, insulating materials, electric hotplates, fuse-blocks, radio communication supplies, mica products and electric furnaces. Connecticut houses bid on copper tubing, insulating materials, a group comprising 770 electrically driven bilge pumps, and wiring supplies for marine light and power circuits.

PACIFIC COAST

Cutting Sunday from working schedule of western shipyards and greater concentration upon the larger and faster Victory cargo carriers is decreasing sales of maritime electric material and fittings. However, when the Pacific drive really begins local emergency stocks are expected to be very useful.

War housing continues to be a major construction item.

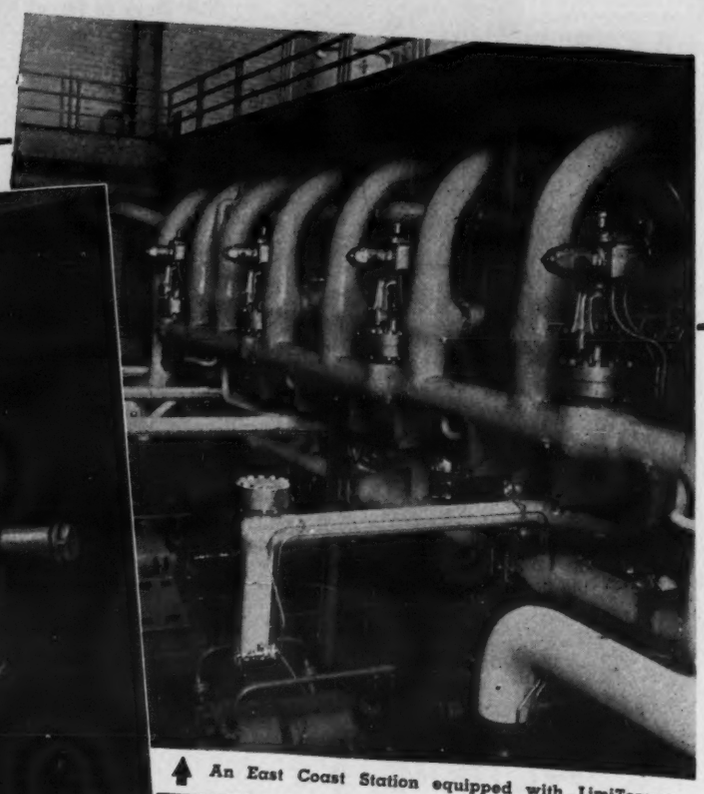
Orders and prospective orders include 61 miles of pole line material for Union Pacific system between Caliente and Rock, Nev., $100,000 being estimated cost of construction; control cable, disconnect switches and potential transformers for Bonneville system, including a Westinghouse award for $8,637 of latter; a California utility central stock order for 60 transformers, sizes 3 to 150 kva., costing $25,000, and twelve welding sets for East Bay shipyard installation, value of $15,000.

Total employment in California manufacturing industries averaged 1,100,000 during 1943, as compared with 856,000 in 1942 and 381,000 in 1939.

From Coast to Coast . . .

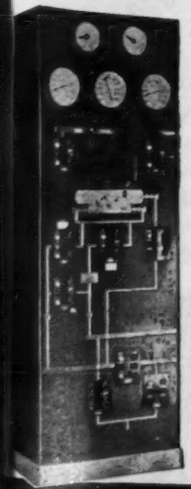
PHILADELPHIA LIMITORQUES

LimiTorque in a California Central Station.



An East Coast Station equipped with LimiTorque.

. . . are providing *Dependable* Centralized Valve Control

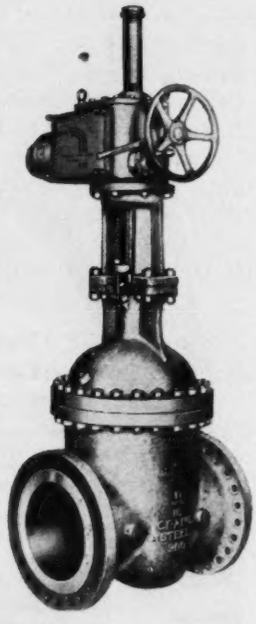


A typical Limitorque Control Panel

The operation of valves in a great many of the newer or modernized power plants and central stations is by Limi-Torque Valve Controls. With these mechanisms, valves can be opened or closed from a central master control panel or convenient individual push button stations. The exact status of the valves can then be known at all times while operations are handled by responsible key workmen. Time and effort are saved and more dependable functioning of valves is assured under any and all conditions.

LimiTorque Controls fit all valves from 3" to 96" diameter and are readily adaptable to existing equipment. . . . So when planning or building a new plant or modernizing an old one, be sure to include Philadelphia LimiTorques.

Our LimiTorque will be of interest . . . send for a copy.



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INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

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Photograph illustrates efficient sure grip and automatic release of Multipoint Hook.

SAVE THE POLES

• The Sturd-E exclusive Multipoint Cant Hook speeds up pole handling and saves the poles—its six quarter-inch by half-inch points grip much more firmly than a single point—in addition, they do not penetrate the creosote treatment. Result—no deep stab wounds where water collects and rot can start.

Made in three sizes for handling all poles—from the smallest to the big ones 22 inches in diameter. Every utility that has tested the Multipoint Cant Hook has reordered in ever increasing numbers—it saves poles, time, and cost.

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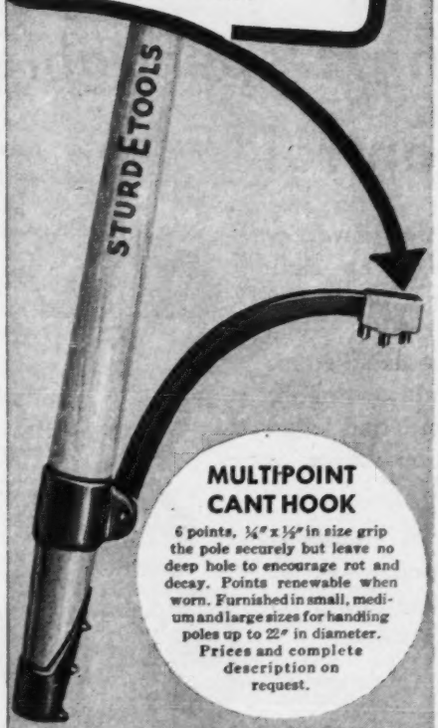
a **TRUE TEMPER PRODUCT**



MULTIPOINT CANT HOOK

6 points, ¼" x ½" in size grip the pole securely but leave no deep hole to encourage rot and decay. Points renewable when worn. Furnished in small, medium and large sizes for handling poles up to 22" in diameter. Prices and complete description on request.

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To Improve Service at Peterborough, N. H.

Public Service Co. of New Hampshire has established an interconnection between the generating plants of the Verney Mills at Peterborough and the local 4-kv., 3-phase, 4-wire, grounded neutral system of the utility in that community to provide standby facilities in case of trouble on the incoming 13.2-kv. connection normally supplying the town. The agreement is for two years with provision for renewal.

Eliot Priest, Keene district manager of the company, stated to ELECTRICAL WORLD that the present peak load at Peterborough, which includes a considerable number of electric ranges and other essential services, is about 640 kw. The power company is permitted to call upon the mill plants for surplus energy in emergency, these installations including 500 kw. in hydro and 500 kw. in steam turbine and boiler equipment, with 575-volt generation. Three 200-kva. transformers have been installed to tie these units into the utility system.

Except in the dry season, these small hydros on the Nubanusit River suffice for the mill requirements. The boiler plant is maintained in service for process steam supply at all times, and in case of low water in the river, the turbine unit can be brought into service in a short time. The mill furnishes attendance. In addition to these improvements of supply, the utility is re-insulating its 13.2-kv. line from Keene to Peterborough.

•

OWU Approves Steam-Generating Units

Three steam-generating units, part of the 1945 power program, have been given Office of War Utilities' approval. AA-3 ratings have been assigned a 20,000-kw. steam unit for the Hattiesburg, Miss., plant of the Mississippi Power Co. and a 7,500-kw. unit for the Portsmouth plant of the New Hampshire Gas & Electric Co. Similar rating will be given another $50,000-kw. generator for the Buzzards Point plant of the Potomac Electric Power Co., Washington.

•

Acquires Additional Space

Western Electric Co. has leased 200,000 sq.ft. of floor space in two industrial buildings in Lincoln, Neb., which will be devoted to war production. The necessary work to adapt these buildings to war production will be started as soon as possible.

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how's YOUR quota?

. . . YOUR 4TH WAR LOAN QUOTA

WHETHER your plant meets its quota, or fails, lies largely in *your* hands. Your leadership can put it over—but if you haven't already got a smooth running, hard hitting War Loan Organization at work in your plant, there's not a minute to lose.

Take over the active direction of this drive to meet —*and break*—your plant's quota. And see to it that every one of your associates, from plant superintendent to foreman, goes all-out for Victory!

To meet your plant's quota means that you'll have to hold your present Pay-Roll Deduction Plan payments at their all-time high—plus such additional amounts as your local War Finance Committee has assigned to you. In most cases this will mean the sale of *at least* one $100 bond per worker. It means having a fast-cracking sales organization, geared to reach personally and effectively every individual in your plant. And it means hammering right along until you've reached a 100% record in those *extra* $100 or better—bonds!

And while you're at it, now's a good time to check those special cases—*growing more numerous every day*—where increased *family* incomes make possible, *and imperative,* far greater than usual investment through your plant's Pay-Roll Deduction Plan. Indeed, so common are the cases of two, three, or even more, wage-earners in a single family, that you'll do well to forget having ever heard of '10%' as a reasonable investment. Why, for thousands of these 'multiple-income' families 10% or 15% represents but a paltry fraction of an investment which should be running at 25%, 50%, or more!

After the way you've gone at your wartime *production* quotas—and topped them every time—you're certainly not going to let anything stand in the way of your plant's breaking its quota for the 4th War Loan! Particularly since all you are being asked to do is to sell your own people the finest investment in the world—*their own share in Victory!*

ET'S ALL
BACK THE ATTACK!

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Sales Opportunities

MARYLAND—Glenn L. Martin Co., Middle River, near Baltimore, plans power substation in connection with expansion in plant, to include several shops, hangar, pumping plant and other structures, with mechanical and electrical equipment. Entire project estimated to cost over $700,000 and will be placed under way soon. Albert Kahn, Inc., New Center Building, Detroit, Mich., is architect and engineer.

INDIANA—Muncipal Utilities Department, Garrett, plans expansion and improvements in power plant as a post-war project, with installation of additional equipment. Cost estimated about $180,000, including extensions in street-lighting system.

GEORGIA—Water Department, Atlanta, plans improvements in power facilities at pumping station, with installation of new boilers, stokers, coal-handling machinery and other equipment, estimated to cost about $200,000. Application has been made for a priority rating. W. Zode Smith is general manager of department.

OHIO—Jack & Heintz, Inc., 17600 Broadway, Bedford, manufacturer of aircraft starters and other plane accessories, plans expansion in plant for production for government, including additional buildings with machinery and electrical equipment. Cost estimated about $2,000,000, with financing by Defense Plant Corp. Work will be carried out soon.

MISSOURI—Columbia Bottoms-City Municipal Airport Commission, M. M. Kinsey, 311 City Hall, St. Louis, chairman, plans second municipal airport for city, including hangars, shops and other buildings, with mechanical and electrical equipment. Also power substation, underground transmission and distribution lines, lighting system with control tower and other facilities. Cost estimated about $11,500,000, with financing in part through federal aid. Horner & Shifrin, Shell Bldg., St. Louis, are consulting engineers. Civil Aeronautics Administration, W. E. Kline, regional director, City Hall, Kansas City, will supervise project.

WYOMING—Shoshone Power, Inc., Cody, J. G. Nichols, president, plans installation of an electrical distribution system in North and South forks of Shoshone River district. Application has been made for a priority rating, with work scheduled to be carried out early in spring.

TENNESSEE—North American Rayon Co., Elizabethton, has plans maturing for large addition to mill for production of high tenacity rayon yarn for tire cord manufacture, comprising main one and multi-story building and auxiliary structures, with machinery and electrical equipment. Cost reported over $1,200,000. Moran, Proctor, Freeman & Mueser, 420 Lexington Ave., New York, N. Y., are consulting engineers.

CALIFORNIA—City Council, South Gate, has preliminary plans for installation of an ornamental street-lighting system on Firestone Blvd., close to 2½ miles, with standards, underground feeder lines and other facilities, to be carried out as a post-war project. Cost estimated about $92,000.

CALIFORNIA—Consolidated-Vultee Aircraft Corp., Vultee Field, Downey, plans expansion in a plant for production for govern-

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The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

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MUNCIE, INDIANA

ent, including additional building, with echanical and electrical equipment. Cost out $300,000, with financing by Defense ant Corp. Work will begin soon. Main ices are at Nashville, Tenn.

WASHINGTON—Inland Empire Rural Elec- fication, Inc., Colfax, plans new trans- ission line and distributing system. Appli- tion has been made for permission.

NEW YORK—Canada Dry Ginger Ale, Inc., 0 East 42nd St., R. W. Moore, president, arranging large post-war expansion pro- am for construction of new bottling, rage and distribution plants in number cities in various parts of country, where es have or will be acquired at early date, luding Philadelphia, Pa., Washington, C., Newark, N. J., Detroit, Mich., Den- r, Colo., Minneapolis and St. Paul, Minn., n Diego, Calif., Portland, Ore., and attle, Wash. Each will consist of one or re buildings, with mechanical and elec- cal equipment for large output. No official imate of cost announced, but will repre- nt total gross investment reported in ex- s of $1,000,000.

MICHIGAN—Department of Utilities and blic Works, Marquette, Stephen L. Gar- r, general manager, plans call for bids rly in February for new tainter gates and ists at municipal hydroelectric power tion dam, No. 3 power plant. Holland, kerman & Holland, 20 North Wacker Dr., icago, are consulting engineers.

MONTANA—Bureau of Reclamation, Den- r, Colo., plans early resumption of con- uction of second unit of Buffalo Rapids igation project, which has recently re- ved presidental approval and for which ority ratings are scheduled to be au- rized by WPB. Work will include new in pumping plant, with motor-driven mping machinery, controls and auxiliary uipment. The program which is to be ried out at this time is estimated to cost 628,000.

REGON—Columbia Metals Corps., Securi- s Bldg., Seattle, Wash., has selected tract about 100 acres of land for site for pro- ed new plant for extraction of alumina m clay. It will comprise several large cessing and production units, with me- nical and electrical equipment. Also uctures for auxiliary operating service, luding machine shops, laboratory, ad- inistration building, etc. A power substa- n will be built, with several smaller nsformer stations at different points. It nderstood that power supply will be ured from Bonneville transmission sys- , which will be extended to plant site. tire project will cost approximately 500,000, and will be financed by Defense nt Corp. Chemical Construction Co., 30 kefeller Plaza, New York, N. Y., is en- eer and will supervise construction.

MISSISSIPPI—Armstrong Tire & Rubber Natchez, has plans maturing for one- y addition, about 200x300 ft., for manu- ture of automobile tires from synthetic ber, with machinery and electrical equip- nt for large output. Cost of project, in- ding equipment estimated over $350,000. rk is scheduled to begin soon. James Canizaro, Capitol National Bank Bldg., kson, is architect.

OKLAHOMA—Water Department, Okla- na City, plans pumping station in con- tion with new filter plant, with motor- ing pumping machinery, controls and essories. Cost estimated close to $800,- Application is being made for a prior- rating.

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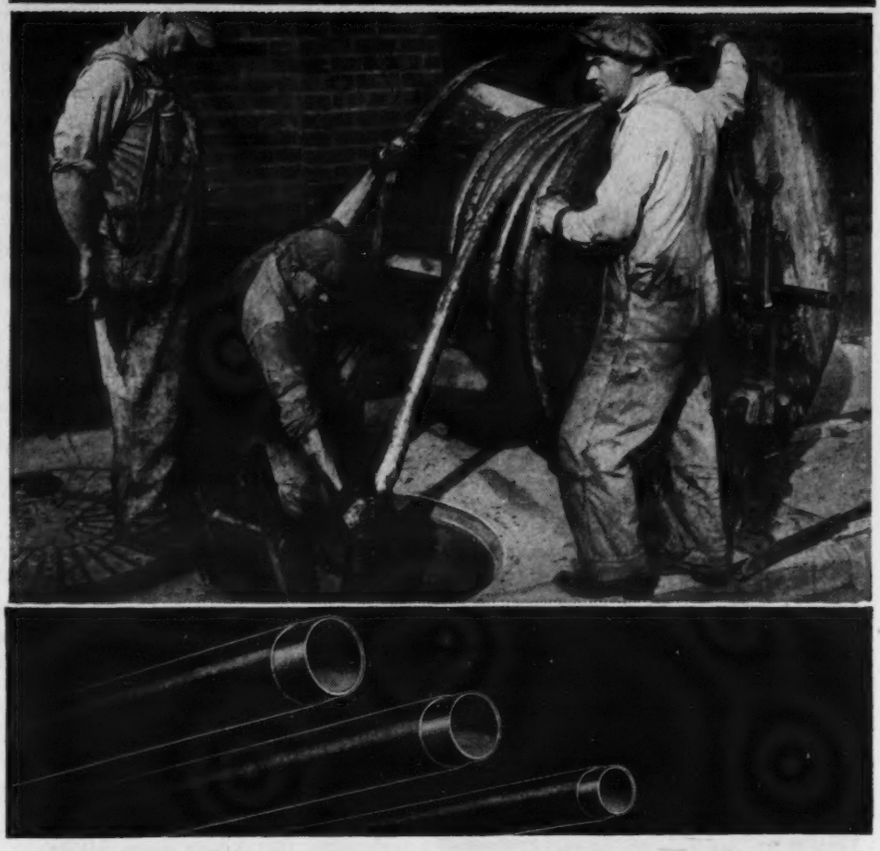
• Prolongs Life of Cable
• Reduces Current Failures



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CINCINNATI, OHIO

New Funds Allotted for Rural Projects

The Rural Electrification Administration has recently announced allotments totaling $1,652,500 to 23 co-operatives in 15 states. These loans, all made in conformity with WPB authorization or regulation, bring total REA allotments to date to $475,152,473, of which $8,204,178 represents operations in the current fiscal year. The funds will be used to acquire existing properties which will facilitate electrification of additional farms in the post-war period and to extend service immediately to nearby farms meeting WPB standards under the increased food production program.

Included are the following:

ARKANSAS—Farmers Electric Co-operative Corporation, Newport, $70,000; North Arkansas Electric Co-operative, Inc., Salem, $60,000.

COLORADO—Intermountain Rural Electric Association, Littleton, $50,000.

DELAWARE—Delaware Rural Electric Association, Greenwood, $60,000.

FLORIDA—Suwanee Valley Electric Co-operative, Inc., Live Oak, $20,000.

LOUISIANA—Teche Electric Membership Corporation, Centerville, $25,000.

MICHIGAN—Presque Isle County Electric Co-operative Association, Onaway, $30,000.

MINNESOTA—Stearns Co-operative Electric Association, Melrose, $100,000; Minnesota Valley Electric Co-operative, Jordan, $74,000.

MISSOURI—Sac-Osage Electric Co-operative, El Dorado Springs, $90,000; Barton County Electric Co-operative, Lamar, $45,000.

MONTANA—Horn County Electric Co-operative, Inc., Lodge Grass, $41,000.

OKLAHOMA—Cotton Electric Co-operative, Walters, $100,000: Kay Electric Co-operative, Blackwell, $80,000.

OREGON—Coos Electric Co-operative, Inc., Coquille, $519,500.

PENNSYLVANIA—Claverack Electric Co-operative, Inc., Towanda, $50,000.

TEXAS—Sam Houston Electric Co-operative, Inc., Livingston, $50,000; Taylor Refrigeration Co-operative, Inc., Merkel, $25,000; Cooke County Electric Co-operative Association, Muenster, $20,000; Johnson County Electric Co-operative Association, Cleburne, $15,000.

VIRGINIA — Shenandoah Valley Electric Co-operative, Dayton, $50,000.

WISCONSIN — Chippewa Valley Electric Co-operative, Cornell, $28,000; Clark Electric Co-operative, Greenwood, $50,000.

•

Recent Rate Changes

HOUSTON LIGHTING & POWER CO. has announced a reduction in residential rates, which will save the company's customers in excess of $214,000 a year. The reduction is in the second stage of the light schedule, which applies to kilowatt-hours used in excess of 12 kw.-hr. and up to 75 kw.-hr. and means a reduction of 12.6 cents a month for every customer using 75 or more kw.-hr. monthly. This is the twenty-first reduction in rates made since 1915 when the profit-sharing plan was adopted with the city, H. O. Clarke, Jr., vice-president

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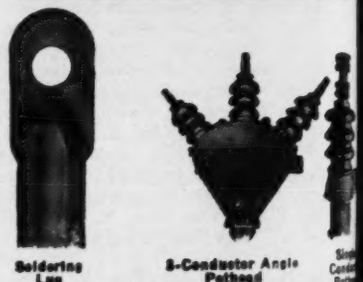

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and assistant general manager of the company pointed out. Under the new schedule, customers will be charged a flat 50-cent minimum monthly, which will pay for 12 kw.-hr. The next 63 kw.-hr. will be charged at the rate of 3.3 cents a kilowatt-hour. Energy in excess of 75 kw.-hr. will continue to bear the same charge as formerly, 2 cents a kilowatt-hour. The reduction is in the second stage from 3.5 cents a kilowatt-hour to 3.3 a kilowatt-hour. The reduction will apply to residential consumers only in all 17 cities, suburban communities and rural sections served by the utility, Mr. Clarke said.

WISCONSIN PUBLIC SERVICE COMMISSION has announced annual rate reductions of $3,378 by the Sun Prairie municipal electric utility and $2,382 by the Juneau municipal utility. The new Sun Prairie rates became effective January 1 and will mean annual savings of $2,226 to 507 residential and rural customers, and $1,152 to 116 commercial, power and street lighting customers. Juneau rate reductions will go into effect February 1 and include $1,041 savings for 348 residential users, and $1,341 to 115 commercial users.

MENOMINEE & MARINETTE LIGHT & TRACTION CO. has announced a street lighting rate cut for the city of Marinette. The new street lighting rates represent a $2,237 cut in present annual street lighting costs.

BOOKS RECEIVED

A Primer of Electronics. Don P. Caverly. McGraw-Hill Book Co., 235 pages, illustrated. Price $2.

This is not quite "basic English," but it is about as elementary an ushering into the concepts of electronics as is conceivable. There are even many professing to know about conventional power-electricity who will welcome the very simplicity of language. Familiar ideas about sound, light, radiant heat, ultra-violet, X-rays and subsonics are drawn upon in elucidating emission, electromagnetic radiation, rectification, amplification, fluorescence, photo electricity, television and the electron microscope. And, be it said, very few liberties are taken with the hypotheses expounded in advanced treatises.

Power Unleashed. By M. M. Samuels. Dorset House, Inc., New York. 301 pages, price $3.50.

Probably no field of industry and professional activity is at the same time better accepted and less understood than the electrical. Those invisible electrons and flux lines and potential differences are just too elusive for the lay mind to grasp. Add to that the mesh of distrust which has been spun about the business and one has ample reason for craving a book which would dissolve half the mystery and most of the skepticism. This is just what this widely known REA engineer has produced.

Of course, purists will find dubious analogies in it and pedagogues occasional departures from scientific rigor. Let them—the book was not conceived for them but for an avid public hoping to have the curtains drawn aside so they can get, in rudimentary English, the lingo and tricks by which the electrical power engineer contures his impressive results. Homely counterparts unravel some of the terminology and concepts but the going gets a bit tough, even for this versatile author, when he delves into the proverbially abstruse power factor. Maybe a diagram here and there would have helped but they probably were

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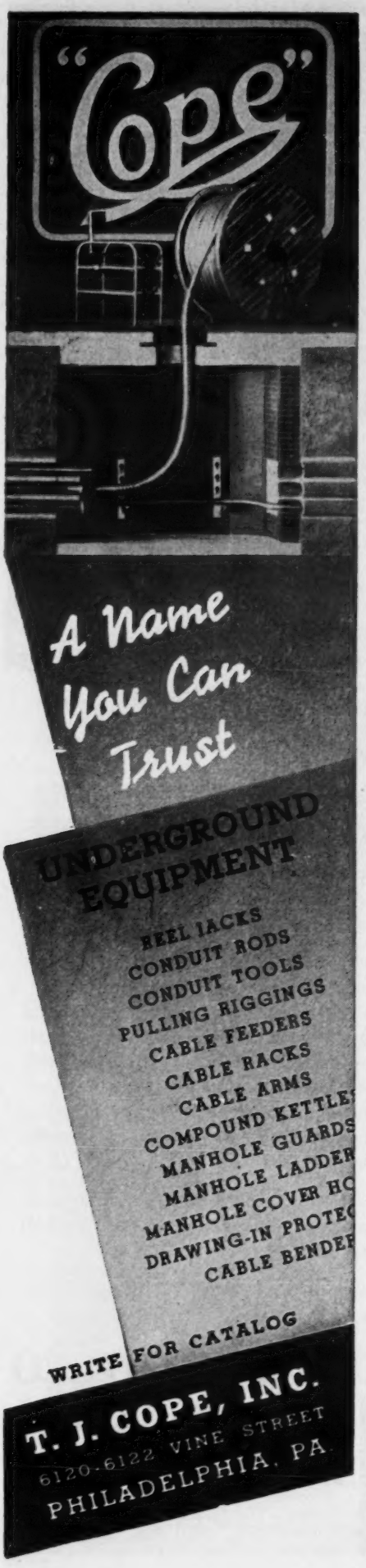

eschewed as savoring too much of the forbidding textbook.

In all, the utility man looking for a simpler exposition than he can concoct will find it in profusion here. The tour through the steam plant is a classic; professors will have to watch that their inspection-trip-reporting students don't "crib" it piecemeal or in toto. Incidentally, the teacher can well resolve his discomfiture with the difficult "dumbbell" pupil (who merely got a bad start in the fundamentals) by sending him to read the early pages of Samuels for a refreshing re-start.

Engineers can be thankful that a closing chapter was included because it is a creditable portrayal of the important problems they are confronted with solving. Its adept treatment provides ammunition for he vocational orientation course and further ammunition for those espousing the cause of the professional engineer.

And be it said there is precious little in the discussion of hydro vs. steam or of power economics to which the overzealous adherent should take umbrage.

There is no index. A worth-while book like this deserves one.

Fundamentals of Telephony. By Arthur L. Albert. McGraw-Hill Book Co., New York, N. Y. 374 pages, illustrated. Price $3.25.

Unusually lucid explanations are given of the equipment and circuits required for modern telephony in urban, rural and toll service. In preparation for an adequate grasp of the refined functioning of the systems there is helpful discussion of the pertinent phenomena of sound, reverberation, acoustics, noise, attenuation, electrolysis and cross talk. Of particular interest to power folk will be found a clear discussion of inductive interference, the basic principles of inductive co-ordination and the application of carrier frequencies. Any one who knows the fundamentals of electric circuits will appreciate the care the author takes to keep the treatment from becoming obscure.

Time Bases. By O. S. Puckle. John Wiley & Sons, Inc., New York. 204 pages, illustrated. Price $2.75.

This is essentially a reference book for the experimenter with the cathode-ray oscillograph because it presents a round-up of time-base techniques (over 40 classifications). It recalls old efforts as well as newly successful methods for linear, trigger, flip-flop, blocking, inductive-time, circular, saw-tooth, trace-linearization, push-pull deflection and synchronization. Appendices extend the presentations into differentiating and integrating circuits, the generation of square-top waves and the means of shifting phase of sinusoids. The author is in the London research department of A. C. Crossor, Ltd.

Applied Safety Engineering. By H. H. Berman and H. W. McCrone. McGraw-Hill Book Co., New York. 189 pages, illustrated. Price $2.

Emphasis is on facts behind accidents, how they can be brought out in investigation, reported and corrections recommended. Treatment is essentially by case method with sample documents. Examples are of a ladder, a crane, a scaffold, chipping (goggles), crew transportation (traffic), handling concrete forms. "How" is stressed for the guidance of those who know the arguments for safety programs. The latter third then gives wholesome advice on how to write rules (the samples tie in with the cases named), how to make talks and conferences effective. One of the authors is safety engineer for the Baltimore electric utility.

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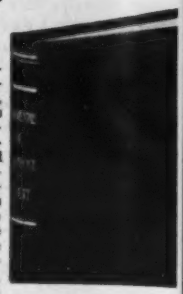

An elementary book devoted exclusively to telephone communication, presenting the principles of electricity and acoustics upon which telephone practices are based and considering telephone transmitters, receivers, telephone sets and circuits, telephone lines, manual telephone systems, dial telephone systems, loading, telephone measurements, noise and cross-talk, and repeaters and carriers. **By Arthur L. Albert, Oregon State College. 374 pages, 200 illustrations, $3.25.**

ELECTRIC CIRCUITS AND FIELDS

Written from an engineering point of view, this book gives explanations and theories of electric circuits, experimental phenomena, and electric and magnetic fields. Here is a general qualitative theory correlating fundamenal phenomena encountered in electrical engineering, and the basic principles, stated mathematically, for calculating quantitatively the effects of connection and use of simple electrical devices. **By Harold Pender and S. Reid Warren, Jr., Moore School of Electrical Engineering, University of Pennsylvania. 534 pages, 148 illustrations, $4.00.**

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Huge Post-War Rural Electric Plan

Plans for a three-year post-war rural electrification program of "well over $500,000,000" were disclosed recently by William J. Neal, of Washington, chief deputy administrator of the Rural Electrification Administration.

Speaking at the annual banquet of the 8th Regional Office of the National Rural Electric Co-operative Association in Little Rock, Ark., Mr. Neal said it would result in the sale of at least a half billion dollars of farm and home electrical appliances.

"We are making plans to be ready for action," Mr. Neal said. "Present studies indicate that with a minimum of expense and effort, REA, its co-operative borrowers and others, working together, can have available at a moment's notice a post-war construction program of well over $500,000,000 in the first three years. It should be borne in mind that such a program will open a market for at least an equivalent amount of farm and home appliances."

Delegates previously adopted a resolution calling for the expenditure of $40,000,000 in post-war construction of electrical facilities in the four states of the 8th Region, including Arkansas, Oklahoma, Missouri and Louisiana.

•

Niagara Falls Power Asks Stock Reduction

The Niagara Falls Power Co. petitioned the Public Service Commission last week for consent to reduce its capital stock from $35,575,565 to $21,077,796.89, it was announced by Earle J. Machold, president of Niagara Hudson Power Corp., parent company of Niagara Falls Power. The purpose of the petition is to enable the company to charge against capital surplus $14,497,768.11 in connection with the write-off of book cost of property previously ordered by the F.P.C.

•

Post-War Electric Plans

A recently completed survey has disclosed that the expansion of railroad electrification in the post-war period is being considered by some carriers as a method of meeting competition of other transportation agencies.

Adoption of large-scale electrification programs would involve a major contribution to the employment problem at a time when it will be necessary to find jobs for returning servicemen and to absorb workers released by the war industries, it was pointed out.

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Continued on pages 212, 213

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1—	350	G.E.	MPC	230	450
2—	300	G.E.	DMC	230	400/600
1—	300	G.E.	MPC	230	275/550
2—	270	Whse.		500	250/400
1—	250	Al. Ch.		230	525
2—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
3—	150	G.E.	RC-19A	230	800/1000
1—	150	Whse.	SK-201	230	300/900
1—	150	G.E.	MPC	230	250/450
2—	125	G.E.	CO-1833	230	625
2—	120	Whse.	SK-180	230	720
3—	100	G.E.	LC-50	230	1200
1—	100	Al. Ch.		230	950/1150
1—	100	G.E.	MPC	230	225/450
2—	100	G.E.	RC-19	230	575/720
1—	75	G.E.	LC	230	500/1000
3—	75	Whse.	SK-183	230	560/1100
1—	60	El. Dy.	258	230	525/1050
3—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr. Wh.	CMC-81H	230	300/900

TRANSFORMERS

	KVA	Make	PH Type	Voltages
6—	1667	Pitts	1 OISC	13200x2300
2—	1050	G.E.	3 WCTH	11000x445
1—	600	G.E.	3 HT-OISC	11550x2200
3—	333	Moloney	1 C-OISC	22000/11000x2300/575
2—	333	Whse.	1 OISC	2300x460
2—	333	Pitts.	1 OISC	2400x220
2—	300	G.E.	1 H-RP	13200x575/1150/2300
1—	300	Pitts.	3 ODSC	4150x208/120
3—	300	Packard	1 OISC	2200x220/440
2—	200	G.E.	1 H-LDD	26400x115/460
3—	200	G.E.	1 H-OISC	2300x115/230

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1000 KW GE 600 V. Gen. d.c. to 1400 HP ATI 2300/4000 V. Syn. with Exciter.
1—1000 KW Whse. 600 V. Gen. d.c. to 1400 HP 4000 V. Syn.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW G. E. 250/275 V. Gen. to 700 HP ATI 440/2300/4000 V. Motor.
1—300 KW G. E. 250 V. Gen. to 400 KVA 440 V.
2—100 KW Whse. SK 250 V. Gen. to 150 HP Syn. 2300 V. 900 RPM motor with excit.
1—75 KW G. E. 125 V. Gen. to 120 HP IK 4000/2300 V. motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	13200
1—	1000	Whse.	900	600	11000
2—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
2—	375	G.E.	1200	250	6600/2300
3—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	
1—	250	G.E.	ATI	220	
1—	225	G.E.	ATI	240	
1—	220	Whse.		440	
1—	150	Al. Ch.		2300	
1—	150	Whse.	G	2300	
1—	150	Whse.		2200/550	
2—	100	Whse.	G	2200	

Slip Ring

1—	1200	Cr-Wh.	801-Q	2200
1—	800	Whse.	CW	440
1—	800	Al. Ch.		440
1—	600	G.E.	IM	440
1—	450	Whse.	CW	2200
1—	400	G.E.	MT	550/440
1—	400	Al. Ch.		2300
1—	350	G.E.	IM	2300/4000
1—	300	Whse.	CW	440
1—	300	G.E.	IM	440
2—	250	G.E.	MT	440
1—	250	G.E.	MT	4000/2300
2—	200	G.E.	IE-M	2200
2—	200	Whse.	CW	2200
1—	200	G.E.	IM	440

Squirrel Cage

1—	500	G.E.	1-17B	2200
1—	400	Whse.	CS-1104A	2200
1—	300	Whse.	CS	550
1—	300	G.E.	IK	2300
1—	250	Al. Ch.		220/440

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	ATI	2200/3800
1—	750	G.E.	ATI	220/440
1—	600	G.E.	ATI	220/440

PENNSYLT RELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

RELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

2—2000 KW **G.E. Rotary Converters,** HCC, 250/300 Volts D.C. booster type. Each complete throughout. Transformers 4600/2300 v. 3/60. Can be seen running.

1—3000 KVA **Synch. Condenser,** 3/60/2200, 900 RPM. With Transformers, 1/60 — 22000/19800 to 2200 volts. Complete, can see running.

INDUSTRIAL TRADING CO.

30 Church St. New York, 7, N. Y.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries Transformers, Motors, Compressors, etc.

Service backed by 38 years' experience

BREW, WOLTMAN & CO.

52 Church St. New York, 7, N. Y.

J.L.HEMPHILL & CO. Inc.
ELECTRICAL ENGINEERS AND EQUIPMENT
1602 53rd Street, North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTOR—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—400 HP, 514 RPM, 440 volt, Westg., slip ring
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E., sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E., vertical

MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 65 HP, 1000 RPM, G.E., type RC.
1— 50 HP, RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, G.E., 2200-220/440 volts.
2—200 KVA, Allis-Chalmers, 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts
3—100 KVA, G.E., 2200-220/110 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110
3—100 KVA, Allis-Chalmers, 2400/4150Y-2400
3— 75 KVA, General Electric 2200/220/440.

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 6 KW, 125 volt, General Electric, squirrel cage.

MOTORS—VARIABLE SPEED 230 VOLTS

1—150 HP, 350/1050 RPM, Crocker-Wheeler.
1— 90 HP, 470/940 RPM, General Electric.
1— 75 HP, 525/1575 RPM, Electric Dynamic.
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 35 HP, 350/1050 RPM, Electric Dynamic.
1— 30 HP, 225/900 RPM, Crocker-Wheeler.
2— 25 HP, 300/900 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker-Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

TRANSFORMERS

New or used. All types and sizes. Air and oil cooled. Phase changers a specialty.

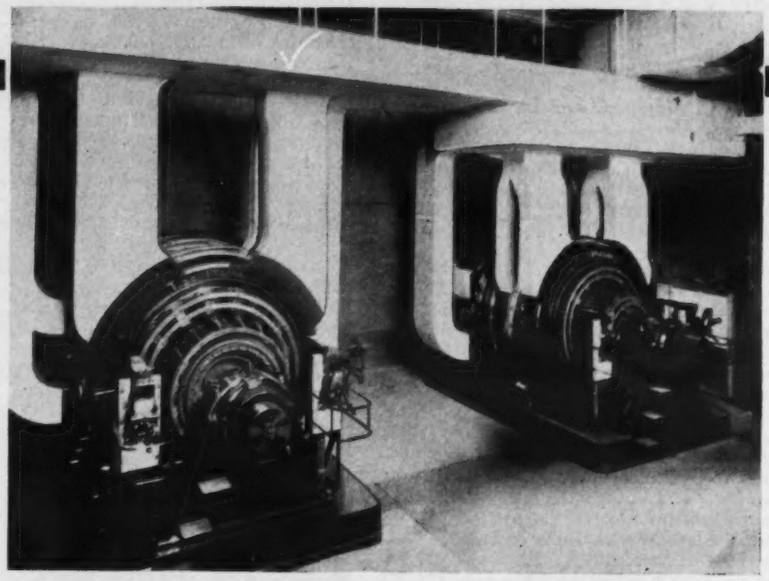
ATLANTIC TRANSFORMER CO.
Transformer Specialists
5143 N. 2nd St. Phila., Pa.

1—375 KW ELECTRIC MACHINERY horizontal generator with direct connected exciter 2300 volt 60 cycles 3 phase 720 RPM with oil switch and rheostats, now on its foundation in good condition. Price $900.00

NORTHERN WISCONSIN POWER CO
Bayfield, Wisconsin

Two Outstanding Offers In

CHICAGO ELECTRIC REBUILT POWER EQUIPMENT



The 2—1500 KW units, as shown above, can be seen running, and can be furnished completely as shown. Write for complete information.

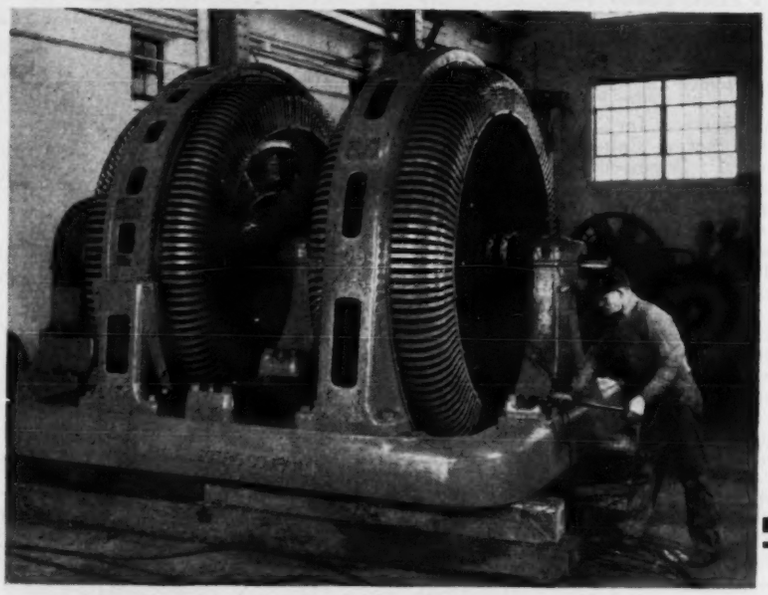
2-1500 KW WESTINGHOUSE M. G. SETS

1 These sets as illustrated at right consist of 1500 KW Westinghouse, 250 volts, 360 RPM, d. c. generators, with commutating interfield poles, direct-connected on sub-base to 2250 KVA Westinghouse synchronous motors, 3 phase, 60 cycle, 12000/2300 volts, 360 RPM.

FREQUENCY CHANGER

2 1—1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph, 60 cy, 460 volt, 300 RPM, 1570 amps, 1250 KVA, 0.9 P.F. 50° synchronous motor with amort. wdg.; dir/conn. to 1000 KW General Electric type ATI-10-1250M-300, 3 ph, 25 cy, 460 volts, 300 RPM, 1570 amps, 1250 KVA, 0.8 P.F. 50° A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.)

1400 H.P. General Electric unit illustrated below is completely rebuilt and ready for service. . . . For additional information WRITE, PHONE OR WIRE TODAY.



CHICAGO ELECTRIC CO.

1314 W. CERMAK RD. CHICAGO, ILLINOIS

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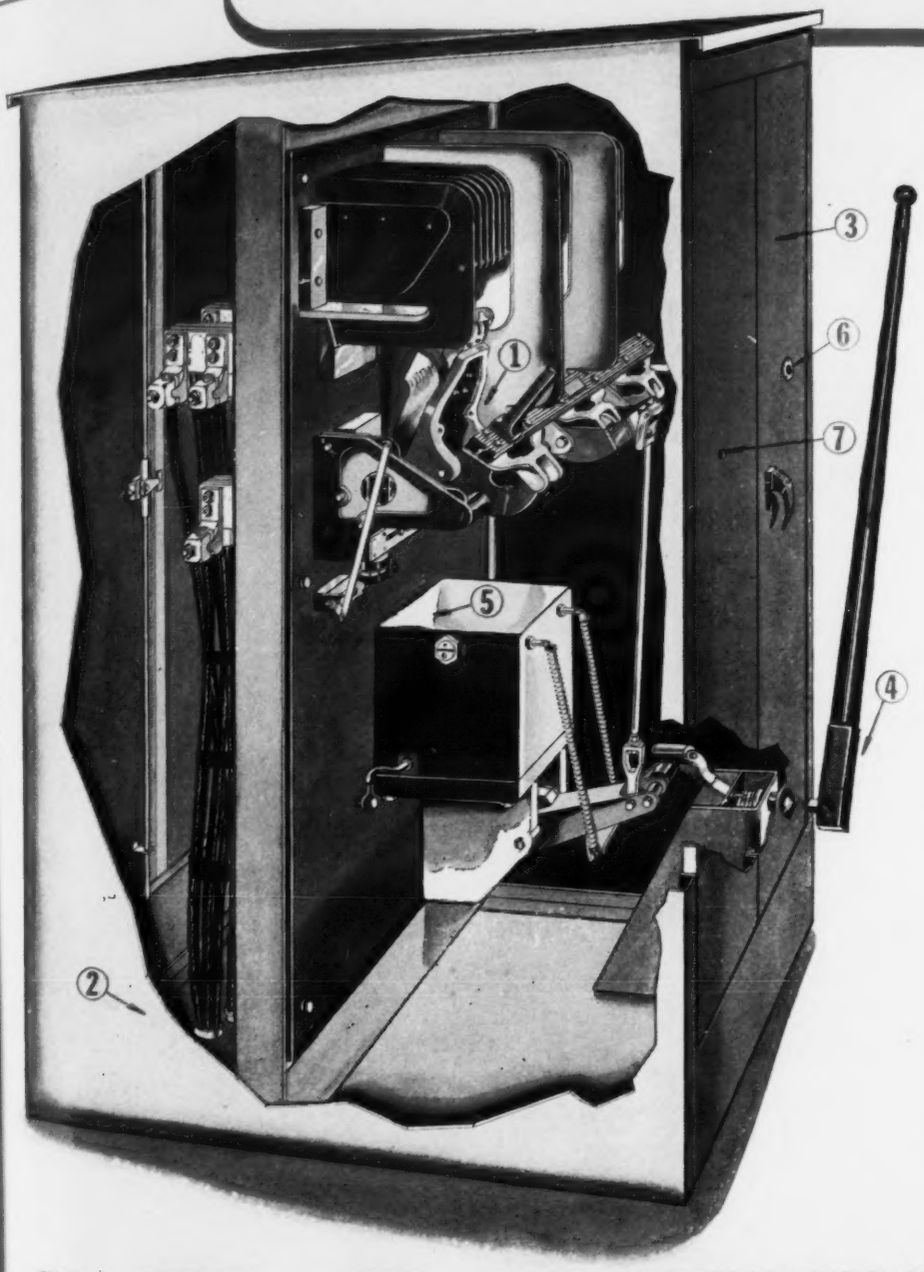
Large I-T-E Circuit Breakers

IN INDIVIDUAL METAL ENCLOSURES

000 to 10,000 Amperes
Up to 600 Volts A-C
or 250 Volts D-C

These large, enclosed I-T-E circuit breakers offer the same dependable service that thousands of U-Re-Lites, or medium-size enclosed breakers, have been giving for years. They are the time-tested type LG, mounted in individual steel cubicles for either indoor or outdoor service. They are easy to install and connect up, require very little maintenance.



(1) The type LG trip free circuit breaker is fully enclosed and protected to give reliable performance.

(2) Steel enclosure protects breaker against accidental damage and prevents men working nearby from touching live parts. The cables may enter at top, bottom or side. Outdoor enclosures are weatherproof, with a sloping roof and projecting eaves.

(3) Hinged doors are easily opened for inspection without removing breaker from service. Three-point latches assure tight closure. Similar rear doors make the connection studs fully accessible.

(4) Outdoor breakers use a removable, rotary, manual operating handle, as shown here. Indoor types may have either a rotary or spade handle.

(5) Solenoid operating mechanism with a trip-free relay is provided for electrically operated breakers. Control power may be d-c or a-c.

(6) Trip button is readily accessible without opening the doors. In outdoor types this button is covered with a flexible, weatherproof diaphragm.

(7) Position indicator may be seen through a small window, showing whether breaker is open or closed.

I-T-E

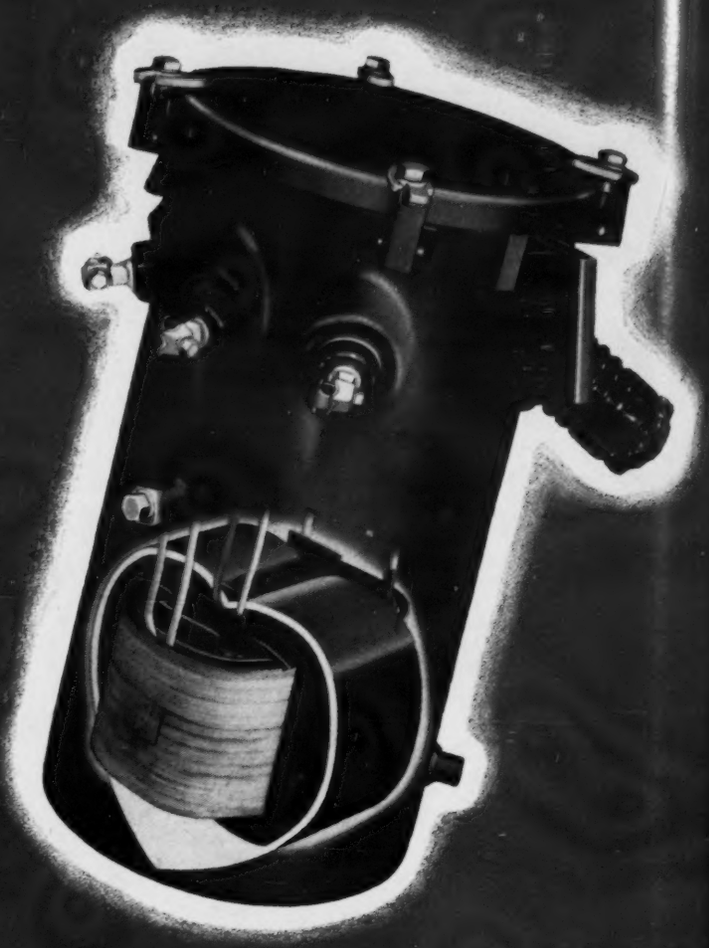
AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

Representatives in Principal Cities

I-T-E CIRCUIT BREAKER CO., PHILADELPHIA 30, PA.

A number of important features have made Kuhlman Distribution Transformers the choice of many utility men. The Kuhlman patented B.I. (Bent-Iron) core utilizes to the fullest extent the many advantages inherent in present day materials. The results of this unique design are lower exciting currents, reduced weight and improved operating characteristics. The tank is made of copper-bearing steel to resist the havoc of rust and corrosion. Pockets for primary and secondary bushings are pressed into the tank to protect bushing seats from the weather. Primary and secondary bushings are sturdily constructed to prevent breaking. In fact, each component part of a Kuhlman distribution transformer is chosen for its ability to take more punishment than it will ever be subjected to in use and thus to give long years of uninterrupted, economical service.



Kuhlman

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICH.